JPRS 78618

28 July 1981

# Japan Report

No. 130

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## MILITARY

### GSDF MAY REQUEST 17 COMMAND/COMMUNICATIONS / C'S

Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 pp 7-8

[Text] The Ground Self-Defense Force (GSDF) is expected to request 17 command/communications armored personnel carriers (APC) as a new procurement item in FY 1982. Funds totaling ¥650 million for them may be earmarked in its FY 1982 budget request, which will be submitted to the Ministry of Finance in late August.

If the 17 units are approved, the GSDF would request 25 to 26 units each in both FY 1983 and 1984 to achieve a target of 68 units stipulated in the FY 1980-84 Medium-Term Defense Program (MTDP). Procurement of the command/communications APCs is likely to continue under the FY 1983-87 MTDP as well.

The command/communications APC has been under development by the Technical R&D Institute (TR&DI) since FY 1978 for improved communication between divisional commands and self-propelled artillery units. Four prototypes have been fabricated for performance and duration tests with Komatsu Ltd. serving as the prime contractor.

Weighing 13.95 tons, the three-axle six-wheel APC measures 5.37 meters in length and 2.8 meters in height. Its maximum speed is 100 kilometers per hour. It is armed with a 12.7mm machine gun and a 7.62mm gun, powered by a four-cycle water-cooled engine and manned by five crewmen.

Following the command/communications APC, the TR&DI is developing a scout/reconnaissance APC with fabrication of a full system planned for FY 1982. Attention is paid to ongoing evaluation of a machine gun to be picked for the vehicle.

CSO: 4120/264

MILITARY

## JDA TO SEEK ADVANCED F-15, P-3C PROCUREMENT

Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 pp 5-6

[Text]

The Japanese Defense Agency (JDA) is certain to seek advanced procurement of F-15J/DJ fighters and P-3C anti-submarine warfare (ASW) aircraft in its FY 1982 (April 1982-March 1983) budget request in late August as proposed by the Air Self-Defense Force (ASDF) and the Maritime Self-Defense Force (MSDF).

The JDA, giving top priority to antiaircraft and anti-submarine defense equipment in its military buildup, expects that the advancement would enable additional procurement of these aircraft beyond the authorized 100 F-15Js/DJs and 45 P-3Cs for an early attainment of equipment targets stipulated in the 1976 National Defense Program Outline.

The ASDF's original F-15 procurement program envisaged orders for 23 aircraft in FY 1978, 34 in FY 1980, 32 in FY 1982 and 11 in FY 1984. After ordering 57 aircraft by FY 1980 as scheduled, it now intends to order all the remaining 43 in FY 1982 so that acquisition of the 100 F-15s will be completed in FY 1986, or one year ahead of schedule. Of the 43 aircraft, it plans to acquire 23 in FY 1985 and 20 in FY 1986.

The service expects to procure more than 70 F-15s in addition to the authorized 100 aircraft because the program outline calls on it to maintain 10 fighter-interceptor squadrons with the number per squadron increased from the current 18 planes to 25. F-15 squadrons are planned to account for six to seven of the 10. The aircraft for additional procurement may be produced at an annual rate of 20 planes.

As to the 45 P-3Cs, the MSDF obtained funding of eight aircraft in FY 1978 and 10 in FY 1980 with 12 scheduled for

FY 1982 and 15 for FY 1984. It has proposed ordering five of the 15 planes for FY 1984 in FY 1982 along with the originally planned 12 in a bid to complete acquisition of the authorized 45 in FY 1987, or one year ahead of schedule. Of the 17 planes, it plans to acquire seven in FY 1985 and 10 in FY 1986.

Additional P-3C procurement is expected to total 40 to 50 aircraft as the MSDF plans that P-3Cs will account for 90 aircraft, or nine squadrons, out of the 100 fixed-wing ASW aircraft, or 10 squadrons, as envisaged by the program outline. The remaining one squadron will consist of 10 P-2Js. The annual production rate for the additional P-3Cs is projected at more than 10 planes.

CSO: 4120/273

MILITARY

## ASDF PREPARING F-4EJ MODERNIZATION PROGRAM

Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 pp 6-7

[Text]

The Air Self-Defense Force (ASDF) is expected to work out a program soon for modernizing the F-4EJ fighter-interceptor as Mitsubishi Heavy Industries Ltd., the prime contractor for F-4EJ license production, has already submitted a detailed proposal on the matter. The FY 1981 budget includes ¥1,330 million for the F-4EJ modernization and ¥720 million for an aircraft structural integration program (ASIP) to lengthen the F-4EJ's service life.

In the modernization, the F-4EJ will be given the look-down capability and armed with such brandnew missiles as the AIM-7F Sparrow and AIM-9L Sidewinder air-to-air missiles and the ASM-1 antiship missile. To this end, its FCS (fire control system) radar will be replaced by an advanced type, for which a promising candidate is the Westinghouse APG-66J. The inertial navigation system will also be modernized. Additional equipment will include a control system for the ASM-1 missile. The communications system will be modernized with vacuum tubes replaced by integrated circuits.

The ASDF is cautious of any excessive F-4EJ modernization which could force the service to use the aircraft over a long time. An excessively long utilization could cause maintenance problems and affect retirement of F-1 support fighters and introduction of an F-XX new fighter-interceptor. Therefore, the ASDF has given up mounting of leading edge slats on the aircraft.

The ASDF's F-4EJ modernization schedule envisages engineering in FY 1981, acquisition of equipment in FY 1982, test improvement in FY 1983 and modification of on-mission aircraft from FY 1985.

CSO: 4120/273

## BRIEFS

BACKUP AIS FOR F-15--The Air Self-Defense Force (ASDF) plans to seek funds for another Bendix avionics intermediate shop (AIS) for testing avionics of the F-15J fighter in its FY 1982 budget request in late August. This is the fourth AIS following those funded in FY 1979, 1980 and 1981 for the currently planned F-15 bases--Nyutabaru, Chitose and Hyakuri. The ASDF is expected to request more AIS systems in the future as F-15J bases increase. The AIS, which is imported from Bendix through C. Itoh Aviation, is an automatic test shop comprising six stations. Delivery of the first AIS, ordered in FY 1979, has recently been completed. Its three stations are being tested at Komaki Minami Works of Mitsubishi Heavy Industries Ltd. (MHI), the prime contractor for F-15J license production. After the tests lasting until September, they will be transferred to Nyutabaru Air Base for assembly with the other three stations. The AIS will be used for operational tests of the F-15J starting at the base in December or later. The second AIS will be delivered by FY 1982 for Chitose and the third FY 1983 for Hyakuri. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 p 5]

CANDIDATES FOR ACMR/I--The Air Self-Defense Force (ASDF) is considering whether to adopt General Dynamic's air combat maneuvering range/instrumentation system (ACMF/I) or Cubic's after its ACMR/I survey team visited the two companies early in June. In the United States, the Navy and Air Force use the General Dynamics system while the Army adopted the Cubic system. The ASDF is expected to favor the General Dynamics system using a larger-capacity computer and portable terminal instruments ( which can evaluate aircraft's attacks on both ground and ships) because it plans to set up terminals on waters for possible joint exercises with MSDF aircraft. The ASDF's ACMR/I procurement schedule envisages the overseas survey in FY 1981, system engineering based on the ASDF's own configuration in FY 1982, manufacture of hardware in FY 1983 and operation from FY 1985. The service plans to set up six terminals in waters off Miyazaki in Kyushu under Aircraft Firing Exercise Spaces R109 and R533. They will be linked with terminals on aircraft and a central station at Nyutabaru Air Base so that the central station will monitor and evaluate firing data with a computer and inform pilots on aircraft of the result and instructions. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 pp 5,6]

POSSIBLE 30 MT-X PER YEAR--The Air Self-Defense Force (ASDF) is expected to order a total of 200 MT-X new intermediate trainers at an annual rate of 30 aircraft over a six-to-seven-year period from FY 1986. But the annual procurement rate could be reduced because of additional F-15J fighter orders expected in these years. Development of the MT-X is to start with basic engineering in FY 1981 and continue for seven years so that the ASDF will acquire the first production models in FY 1988 as replacements for its retiring T-33A and T-1A/B trainers. The development schedule envisages detailed engineering in FY 1932-83, fabrication of preproduction models in FY 1983-85 and technical and operational tests in FY 1985-37. In consideration of the development schedule, the ASDF intends to incorporate an MT-X procurement program into the FY 1983-87 Medium-Term Defense Program to be prepared by the end of the current fiscal year. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 p 6]

HELICOPTER ESCAPE TRAINING SYSTEM--The Maritime Self-Defense Force (MSDF) took delivery at its Kanoya Base from Japan Aircraft Mfg. Co. of a training system for crewmen's escape from ditched helicopters. The system consists of the support, helicopter body, controls and a hydraulic component to train helicopter crewmen so that they can escape from ditched helicopters promptly and safely. The first three components have been manufactured by the company and the hydraulic component by Tokyo Keiki. A special building for the system has been constructed by local contractors. The system, the first of its kind in Japan, is worth ¥100 million and the building slightly more than ¥100 million. The 50-ton system is installed in a 10-meter-wide, 15-meter-long and 5.5-meter-deep pool in the building which measures 20 meters in width, 30 meters in length and 11 meters in height. It can simulate five modes of ditched helicopters, including lateral turning and sinking. The helicopter body is made of fiber-reinforced plastics after the HSS-2B antisubmarine helicopter, weighing about 1.7 tons with four crewmen presumed. The system is being used by the 211th Air Training Group of the MSDF for all MSDF helicopter crewmen. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 pp 6,7]

TORPEDOES FOR P-3C STUDIED--The Maritime Self-Defense Force (MSDF) is considering the U.S. Navy MK-46 and the modified Model 73 as shortrange torpedoes for the P-3C and other ASW aircraft. It has been negotiating with the United States to obtain approval of Japan's MK-46 production under license. Unless all MK-46 components, including the guidance and control section, are released for Japan's license production, however, introduction of the MK-46 would be meaningless. Modification of the Model 73 short-range torpedo is now under way by the Technical R&D Institute to improve its homing performance to cope with highly capable submarines. The TR&DI is also developing the GRX-2 long-range torpedo for submarines. Meanwhile, the MSDF began to equip its aircraft and ships actually with live torpedoes in FY 1980 to improve its readiness. A five-year program was also started in that year to build adjustment and other facilities for mines. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 p 7]

NEW MARITIME PATROL AIRCRAFT--The Maritime Safety Agency (MSA) has inaugurated an aircraft selection committee under the chairmanship of Takashi Noro, Assistant Commandant for Operations. The Falcon 20G, Lockheed L-100-20 and the Fokker F-27 Maritime are reportedly listed as candidate aircraft. In June 1978, the MSA tentatively decided on the adoption of the Falcon 20G and the Lockheed L-100-20 for its maritime surveillance and search/rescue missions. The tentative decision was scrapped, however, during the course of budgetary negotiations with the Ministry of Finance. Due to changes in operational requirements and other factors, the selection of the new patrol aircraft will be made from a clean slate again and a decision is expected to be announced toward the end of this year. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 pp 1,2]

CH-X HELICOPTER MISSION--The Ground Self-Defense Force (GSDF) is negotiating with internal bureaus of the Defense Agency to send a survey mission abroad in FY 1982 for selection of a CH-X transport helicopter as a replacement of the Kawasaki KV-107. The GSDF is required under the FY 1980-84 Medium-Term Defense Program (MTDP) to purchase two CH-Xs for training. The MTDP also calls on the Maritime and Air Self-Defense Forces to procure six new minesweeping helicopters and seven H-X rescue helicopters, respectively, as replacements for their KV-107s. Thus, all the three services are faced with the V-107 replacement problems because they introduced the KV-107 almost simultaneously. Although the three services are to deal with extension of the V-107's service life in FY 1981, the GSDF intends to separate the CH-X introduction from the service-life extension program. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 p 6]

CSO: 4120/273

## TOSHIBA MARKETS 144 K C$^2$MOS-ROM, 4K CMOS/SOS RAM, 4K CMOS RAM

Tokyo TOSHIBA REBIYU in Japanese Vol 36, No 4, Mar 81 pp 338-339

[Text] 3.2 Semiconductor Memory

3.2.1 144 Kbit C$^2$MOS-ROM: Recently, the large capacity ROM has become an indispensable element of industrial and commercial equipment using micon such as electronic translation machines and voice and sound synthesizers. Every company marketed products in which the large capacity ROM is a single channel MOS, and there were no models using CMOS.

This company in January of 1980, developed and marketed the world's first 144 Kbit C$^2$MOS-ROM (T 6025). A photograph of the chip used in this product is shown in Photo 11. This T 6025 is a 12 K word x 12 bit makeup dynamic CMOS-ROM.

The following are the features of this product with respect to its makeup.

1) It is a series type AND-OR configuration mask ROM using P channel MOS.

2) It has a clock generating circuit within its LSI, and the various driving pulses necessary to the dynamic circuit can be generated simply by the chip enable pulse supplied from the outside. Consequently, it resembles a static memory when seen from external sources.

3) It has a latch function which handles all address inputs internally.

4) Output is effective only during CE time, and the $\overline{CE}$ time is a 3-value output of a high impedance type.

5) Memory expansion up to four chips is possible.

6) The chip is sealed into a 56 pin plastic type flat bucket so that it makes possible very compact instruments such as an entire electronic translation instrument.

The principal properties of this ROM are listed below

| | |
|---|---|
| 1) Access time | $^{t}$ACC = 17 µs (typ.), 4.5 V, + 25°C |
| 2) Power consumed during operation | Pd = 630 µW (typ.), 4.5 V, 10 kHz |
| 3) Power consumed at rest | Ps = 0.2 µW (typ.), 4.5 V, + 25°C |

As is evident from the above, this is a large capacity product which is tops even from a worldwide standpoint, and the development of this low power consumption CMOS-ROM was achieved using 4 μ high performance MOS process technology in the production stages and through the use of clocked CMOS within the circuits to provide sense amplifier circuits.

3.2.2 Super High Speed 4 Kbit CMOS/SOS RAM: The development of high speed MOS type static RAM has been encouraged in the past, and the recent situation has seen the need for super high speed memory which also combines low power consumption capability.

With this demand as a background, the high speed and low power consumption features of CMOS technology were exploited on to a SOS base plate, and a 4 K word x 1 bit makeup completely static RAM with maximum access times of 25 ns and 35 ns and standard power consumption of 200 mW which placed it tops in the world with regard to performance was developed. This unit can be sealed into an 0.3 inch wide 18 pin standard plastic package.

Gate width 2 um $MoSi_2$ gate CMOS/SOS technology was applied where process technology was concerned. Finishing standards of 3.5 μm were used at sites other than the gate. A two-stage amplifying mechanism incorporating a new circuit into the sense amp circuit is used, the distribution lines' RC delay within the word selection lines has been reduced through the use of low resistance $MoSi_2$ as gate material, and the use of a small parasitic static capacity characteristic of SOS have enabled the attainment of high speed operation.

This unit is provided with a CMOS/SOS with a 6-transistor memory cell makeup which possesses the possibility of serving as a battery backup. In addition, there need be no concern for any incidence of a latchup behavior which is an advantageous feature of the CMOS/SOS construction, and it is also highly resistant to software error giving it superior reliability.

CMOS/SOS technology not only has high speed and reliability traits which make it standout from the crowd but also is associated with superior element density which gives it a promising future. There are great hopes that this technology will be utilized to develop super high speed memory.

3.2.3 32 Kbit EPROM: Production and sales of the 32 Kbit EPROM, TMM 2732D was initiated from July 1980 as a followup to the TMM 323D. This TMM 2732D has access time of 350 ns and operating current of 150 mA and it represents a one-stage advance over the 16 Kbit EPROM.

The program voltage is 25 V, and irradiation with ultraviolet light of 12,000 $\mu W/cm^2$ is used for erasing. This enables the write-in and erasure of various information, and the same program is used as with the 16 Kbit TMM 323D (2716 type).

The pin array is interchangeable with the 32 Kbit mask ROM TMM 2332P, and it is also possible to convert from EPROM to ROM by altering the print plate.

A 24-pin standard Sardeip [phonetic] DIP is used as package and by assigning the No. 21 pin as the address input $A_{11}$, interchange with EPROM, TMM 323D (type 2716) is made possible.

The principal properties are listed below

| | |
|---|---|
| Access time | 350 ns |
| Current consumption | 150 mA |
| Standby current | 25 mA |
| Read-in condition | 25 V/50 ms |
| Completely static operation | |
| memory constituent | 4,096 word x 8 bit |

3.2.4 4 Kbit High Speed CMOS RAM: The 4 Kbit high speed CMOS RAM TC 5504 AP/ TC 5514 AP incorporates its own 4 k word x 1 bit/1K word x 4 bit makeup, and it has been produced and marketed since March and October of 1980 as a successor to the TC 5504 P/T C 5514 that is now being mass produced.

This RAM has access time of 200 ns and 300 ns and operating current of 5 mA thereby displaying both high speed and low power consumption, and it represents a step forward in improvement in performance compared to TC 5504 P/TC 5514 P. TC 5504 is a synchronous type static RAM which has the input circuit contained within the latch circuit for all circuits except $\overline{CE}$, and it is provided pin interchangeability with TC 5504P. At the same time, TC 5514AP is an address transition detector containing nonsynchronous type static RAM, and it not only has interchangeability with TC 5514P but complete interchangeability with N channel 2114 type RAM all over the world. The standby time is 20 μA over its entire usable temperature range (-30°C~85°C) and small and is said to be best for applications in which it is used as nonvolatile memory for battery backup.

The package is an 0.3 inch wide standard 18 pin plastic or Sardeip package.

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CSO: 8129/1229

# SYSTEM PERFORMANCE EVALUATION AT FUJITSU

Tokyo FUJITSU in Japanese Vol 32 No 2, Jun 81 pp 253-261

[Article by Yoshitaka Sakashita]

## [Text] 1. Introduction

System performance evaluation activity involves the evaluation of total performance including software and hardware to enable improvements in selection of equipment, estimation of handling capability, and improvement in treatment efficiency.

Efforts to improve the various performances of software and hardware have been underway for a long time. In another direction, methods and concepts to improve the treatment capability of the overall systme were initiated at Fujitsu more than 10 years ago. On the other hand, the recent trend to large-scale systems, the introduction of VS (virtual storage), the formation of networks, and the diversification in functions of OS made the operations to improve the efficiency of the overall systme more difficult while, at the same time, the user came to regard this point with greater importance.

While the concepts, materials, and tools which support system performance evaluation activity were gradually developed, it is the situation today that there is still need for the individual's senses in tuning operations particularly on the improvement of programs and operations.

System performance evaluation activity will be described below centered mainly on OS IV/F4 and OS IV/X8.

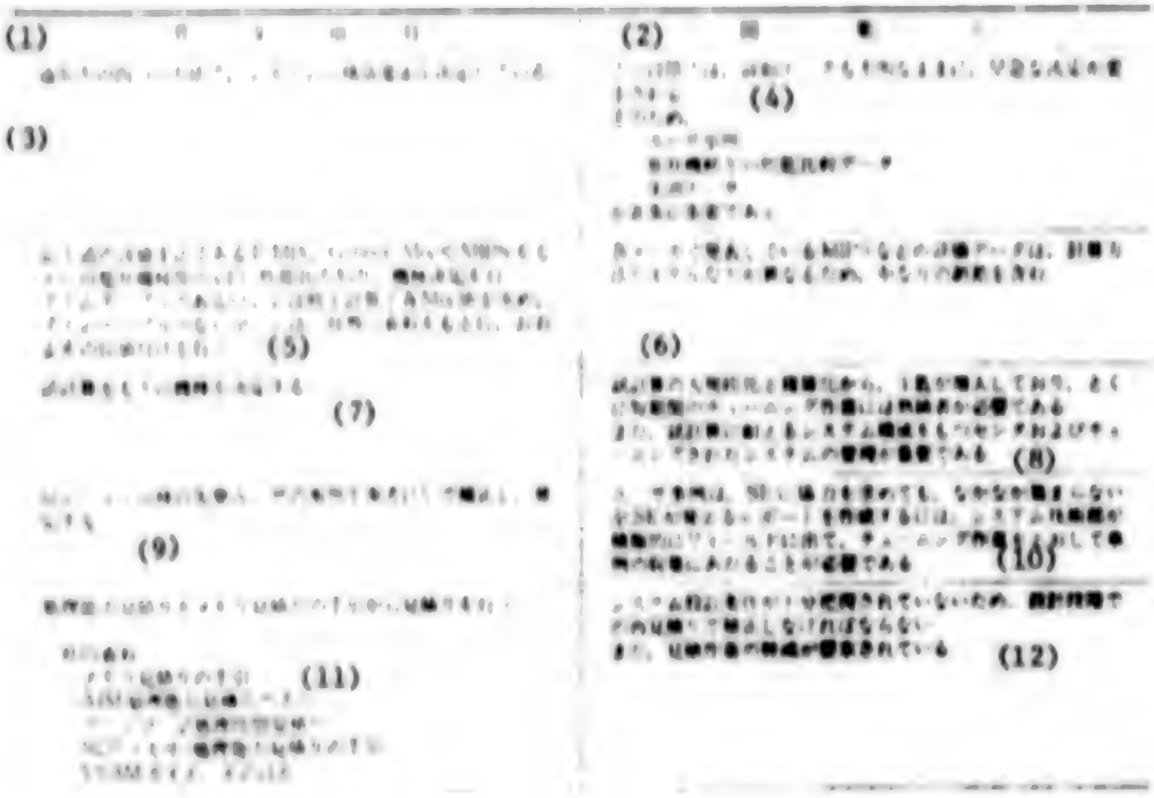
## 2. Contents of Evaluation Activity

The outline, contents, and problem areas of system performance evaluation conducted by SE are listed below alongside each operation stage.

### 2.1 Introductory Study Stage

Performance evaluation related activity at this stage is involved with the pros and cons of the system makeup and establishment of the elements in the makeup in line with the treatment performance requested by the user (see Table 1).

## Table 1. System Performance Evaluation Activity at the Introductory Study Stage


(1)
(2)
(3)
(4)
(5)
(6)
(7)
(8)
(9)
(10)
(11)
(12)

Key:

1. activity item in the usual case
2. problem area
3. The system constitutive elements are determined according to one of the following 4 methods
4. There is need at this stage for a rapid decision despite the lack of detailed data. As a result, the following become very important
   User's precedents
   Comparative performance data from other equipment and other companies
   Actually measured data
5. Use MIX, General MIX, and MIPS which are Fujitsu evaluation methods to establish the CPU performance ratios between their own company and other companies, use desktop calculators to obtain MIX values for machines which have timetables for making machine type determination, and use data from other companies for those machines without timetables to enable approximate position assignment
6. Evaluation data such as MIPS announced by the different makers differ between calculation methods and models and incorporate considerable error
7. Decide on type of machine based on the test calculations

[Key continued on following page]

[Key to Table 1 continued]

8. The number of steps increases with the large-scale and complex test calculations, and there is need for experienced operators particularly on short term tuning operations. At the same time, system control is important for a system which has been subjected to center and tuning operations and with makeup which can cope with test calculations.
9. Make corrections and projections referencing precedents of previous users of the same level and type.
10. User precedents are difficult to amass even through SE efforts. In order to compile a report usable by SE, it is necessary for the system technology section to make every effort to get out into the field and collect precedents through tuning operations.
11. Make estimates based on treatment capability estimates and memory estimates
    - Intracompany material
        - Memory estimate guide
        - AIM treatment capability estimate guide
        - Sortmage /phonetic/ treatment time estimate
        - NCP memory/treatment capcbility estimate guide
        - VSAM guide, others
12. A full grasp of the system design conditions is not at hand which results in the need for reestimating and correcting at the design stage. At the same time, there is need for reduction in estimate activity.

## 2.2 Design Stage

Attention is directed at OS and its subsystem performance and limiting items to conduct basic design and detailed design. Evaluation related activities are inspected along the lines of the following items to see how efficient design can be developed (See Table 2).

Table 2. System Performance Evaluation Activity at the Design Stage

| (1) [illegible] | (2) [illegible] |
|---|---|
| [illegible] (3) | [illegible] (4) |
| [illegible] (5) | [illegible] (6) |
| [illegible] (7)<br>[illegible]<br>[illegible] AIM[illegible] | [illegible] (8)<br>[illegible] AIM, TSS [illegible] |
| [illegible]<br>AIM [illegible]<br>AIM [illegible] (9)<br>[illegible] | [illegible] AIM [illegible]<br>[illegible] (10)<br>[illegible] |

AIM Advanced [illegible]

[Key on following page]

[Key to Table 2]

Key:

1. activity item
2. problem areas
3. Design is initiated using the following activities as check points
4. Items necessary to make treatment capability design and qualitative evaluation may be all at hand except for a fraction, but the following points remain unresolved.
5. Clarify specification states and business volume which were vague during the introductory study stage
6. There is no checkpoint collection for finishing up estimate conditions
7. Separate items which must be executed at the time of design and those which are not as important

   Intracompany material

   Tuning guide: control program compilation
   Tuning guide: treatment program compilation
   Tuning guide: AIM compilation
8. The tuning guide is drawn up with the general system as objective, and there is need for check list for tuning according to patterns classified by activity and scale.

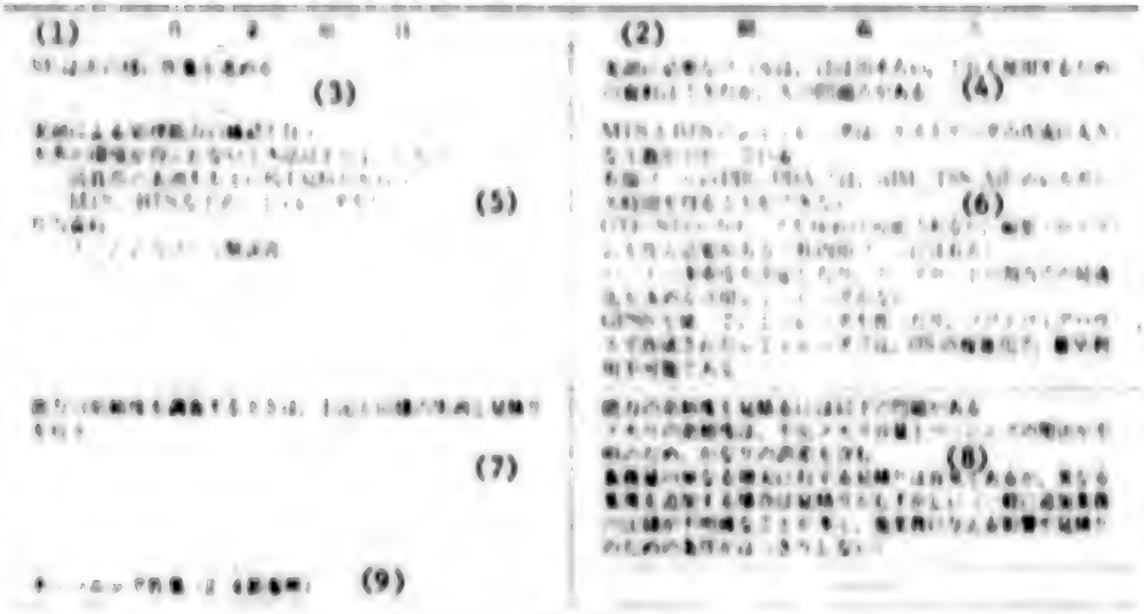
   At the same time, the present tuning guides have AIM and TSS batches as respective isolated material, and there is lack of guidelines for their compound systems.

9. Precedents involving previous users and cases of the same level and same businesses are referenced in order to make efficient design, and the SE handbook is read to assist the study.

   Intracompany material

   AIM system design handbook: On-line compilation
   AIM system design handbook: Data base compilation
   System generation guide
   Handbooks for various estimates (same as those listed in Table 1)
   Various measured data
10. A manual for efficient design is soon to appear along the lines of AIM, networks, and treatment programs, but the following problems still remain.
    The estimates on the relationship between memory capacity and paging are unclear so that the estimates for treatment time and response time cannot be made when paging is numerous.
    There are many cases in which those parameters associated with the generation which are related to performance cannot be determined until the system is used for a given period or the values are actually measured.
    There are many cases in which problems arise during time of operation because no reestimate of memory capacity and treatment capability is made when there is change is design specifications or addition of business.

## Table 3. System Performance Evaluation Activity at Operational Test Stage



AIF : Advanced Interactive Processing Facility
BTS : Batch Terminal Simulator
GTF : General Trace Facilities
GPSS : General Purpose Simulation System
MTS : Multi Terminal Simulator
PDL/PDA : Performance Data Logger/Performance Data Analyzer
STFD : Super Trace Facilities

Key:

1. activity item
2. problem points
3. SE promotes operations in the following manner
4. There are arrays of different tools for the measurements. While the information on their use may be available, the following problem points remain.
5. Recognize treatment capability in the measurements
   When the actual environment cannot be obtained, take the following measures
      Make calculator estimates based on low load results
      Conduct MTS, BTS simulations
   Intracompany material
      System evaluation tools manual
6. A large number of steps are involved in test data compilation with the MTS and BTS simulators. AIM and TSS/ALF response times cannot be obtained for the PDL/PDA of rented tools. While it may be possible if GTF/STFD data could be used, there is need to draw up a compilation program (this is available as in-plant tool)
   There is no general use simulator to obtain optimization of multiple weights of batches or data set divisions.
   Fabrication of simulators using GPSS or simulators made by software houses cannot be used because of the complexities of OS.
7. When examining excess capabilities, estimates are made using the same measurements as above.
8. The following problems appear in estimating excess capacity.
   The relationships between insufficient memory capacity and paging is not

[Key to Table 3 continued]

clear in the degree of excess memory and incorporates considerable error. Estimates related to simple increase in business volume are readily made, but the estimates become difficult when different businesses are introduced. (Generally speaking, specifications of add-on businesses are not clearly known, and the conditions which affect the effects on other businesses are not clearly established.

9. Tuning operation (see Section 2.4)

Table 4. System Performance Evaluation Activity at the Maintenance and Evaluation Stage

| (1) [illegible] | (2) [illegible] |
|---|---|
| [illegible] (3) | [illegible] (4) |
| [illegible] (5) | [illegible] (6) |
| [illegible] (7) | [illegible] (8) [illegible] AIM TSS [illegible] |

Key:

1. activity item
2. problem areas
3. There are the following two kinds of activities
4. There is need to collect various performance data on-site during operation. The activity may become difficult when awareness of the user's system performance evaluation is required.
5. At times addition of business or increase in business volume can trigger lower treatment performance.
   Surveys and tunings are conducted in order to resolve problems.
   Intracompany material
      Tuning guide: control program compilation
      Tuning guide: treatment program compilation
      Tuning guide: AIM compilation
      System evaluation, tool manual
      Tuning precedent

[Key continued on following page]

[Key to Table 4 continued]

6. Although related material and evaluation tools are almost at hand, there are the following problems.
   Many of the evaluation tools except for PDL/PDA which are rented, are intracompany tools. At the same time, intracompany material make up the bulk of related material, and the number of steps which the user can solve himself is small.
   Tuning is difficult unless one is thoroughly familiar with the system.
7. Capacity is estimated, degree of excess capacity of the system is known, and study is made of the operation leveling up schedule of the system in the future.
8. Establishment of method theory is delayed compared to tuning, and material is scarce among some of the problems.
   The problem of establishing the degree of excesses in system capacity is not clearly defined. There is need to measure and know the system treatment capability and degree of excess at fixed intervals, but this is generally not done.
   There is a simple model in which evaluation is by simulation, but it is difficult to use with compound system such as batch, AIM, and TSS.

1) Control Program
Function selection and establishment of system generation macro life parameter.

2) AIM (Advanced Information Manager)
Function selection for design of DB (data base) and DC (data communication) and selection of various parameters.

3) Treatment Program
Consideration of structure of jobs, tasks, and program; number of dynamic steps; and number of I/O access cycles.

4) Data Set
In addition to method to apportion magnetic disk facility volume, composition of data set and determination of block length.

## 2.3 Operating Step Stage

When this stage is entered, the various operating data are handled in the manner given below and the operating order on-site is set up at the end (see Table 3).

1) Recognition of degree of attainment of expected capability

2) Recognition of range in degree of excess capacity

3) Tuning activity

When the anticipated treatment capability is not realized, a tuning operation (see next section) is conducted in an attempt to improve treatment capability.

## 2.4 Maintenance and Evaluation Stage

There are times when performance problems arise after on-site operation during addition of duties or revision of OS. In such situations, the system controller should use the various performance evaluation tools to measure the operating situation of the system and survey the problem areas in treatment capability. After clarifying the problem areas, countermeasures are set up, and improvements are made to the system parameters and programs as well as improvements to operation (see Table 4). This series of operations is called system tuning.

There is also an evaluation activity (cavitation estimate) in which the degree of excess of the present system is surveyed, the trends in present business volume are used to judge the number of years treatment with the present system is possible, or gauge the degree of insufficiency.

## 3. System Evaluation Methods

This section will discuss the outlines of various evaluation methods which are generally conducted followed by the evaluation methods used at Fujitsu.

## 3.1 Outlines of Various Evaluation Methods

There are various methods for evaluating system capabilities. Among the simpler methods is one based on the actual time of execution of the four basic computational commands. In addition, there is a method called the benchmark test (test calculation) which is used in overall evaluation of hardware and software.

These evaluation methods are the basis for performance comparisons between different machines and to provide basic data for treatment capability estimates. Among these methods there are some which today are already unusable because of computer architecture or increased complexity of OS.

The outlines of evaluation method of various types are given in Table 5.

Table 5.  Outlines of Various Types of Evaluation Methods

| (1) 評価手法 | (2) 概要 | (3) 評価 |
|---|---|---|
| (4)<br>サイクルタイム | CPU もしくは主記憶のサイクルタイムから、機種間の性能比を求めようとするものである<br>(5) | [illegible]<br>たとえば、FACOM M-[illegible]AD と FACOM M-[illegible]AD の CPU サイクルは、FACOM M-[illegible]AD の[illegible] (6) |
| (7)<br>[illegible] | (8) [illegible] | [illegible] FORTRAN [illegible] (9) |
| (10)<br>[illegible] | [illegible] (11)<br>[illegible] MIPS [illegible] MFLOPS [illegible] | Gibson Mix [illegible]<br>General Mix [illegible] (12) |
| (13)<br>カーネルプログラム | [illegible] CPU [illegible] (14) | [illegible] CPU [illegible] (15) |
| (16)<br>ベンチマークプログラム | [illegible] (17) | [illegible] (18) |
| (19)<br>シンセティックプログラム | [illegible] (20) | [illegible] (21) |
| (22)<br>[illegible] | [illegible] (23) | [illegible] OS [illegible] (24) |
| (25)<br>モニタリングによる評価 | [illegible] (26) | [illegible] (27) |
| (28)<br>解析的手法 | [illegible] (29) | [illegible] TSS [illegible] (30) |

MIPS: Million Instructions Per Second　　MFLOPS: Million Floating Operations Per Second

[Key on following page]

[Key to Table 5]

1. evaluation method
2. outline
3. evaluation
4. cycle time
5. This method uses cycle time for CPU or main memory to set up performance ratios between various machine types
6. When the computer is a wired logic affair, there is little sense today because of the shift to microprograms although it made sense at one time.

   For example, the FACOM M 160 AD and FACOM M 180 II AD CPU cycles are such that the FACOM M 160 AD gives faster values.

7. time for executing 4 basic computer commands
8. The fixed and floating small number commands are the focus of the computer command objectives, and the times required to execute these commands are used to determine performance ratios between machines
9. This method is often used today and is very effective for comparing computers with large use of FORTRAN computations
10. instruction mix
11. The use frequency is weighted on the commands used in the standard model program to obtain the execution time per command
    Some representative examples are
    - Commercial Mix for business computations (Fujitsu has its COBOL-Mix)
    - There is a Gibson Mix for science and technology computations
    - Fujitsu has a general Mix which can handle combinations of business computations, science and technology computations, and on-line and real time computations.
    - Very recently MIPS is being used just as the MIPS used most frequently in comparisons of different machines to compare performance of floating small number point computational commands in a program called MFLOPS
12. This is a method frequently used centered on the Gibson-Mix. The concept of General Mix is new, but other companies have similar methods
    This considers only hardware performance and not software
    When OS and subsystem change, difference in software performance needs to be considered
    When the computer architecture is different, the number of steps in commands required for the same volume of work differ.
    MIPS is arranged in the order of the reciprocal of the execution time required per command.
    This system is convenient for evaluating multi CPU systems, and it is believed this model will find more general use in the future
13. kernel /phonetic/ program
14. The entire program often used for standardization or the important part of the evaluation objective is coded in CPU machine language, and the CPU time of this program is calculated with a desk calculator
15. Unlike the evaluation of execution time per command, CPU functional comparisons between machines can be made even with different architecture for evaluations at the same workload (on the other hand, software is not considered).
16. benchmark program
17. A user's standardized job is actually executed on a machine, and the treatment time is used to make overall evaluation of the system

[Key continued on following page]

[Key to Table 5 continued]

18. Useful for total evaluation of hardware and software
    Most accurate performance comparison is possible by using user's principal jobs
    On the other hand, the measurement conditions have to be the same, and conditions are difficult to set
    At the same time, a laege number of steps is required for on-line use
19. synthetic program
20. This exploits the features of the benchmark program and incorporates both general use and multiple use capabilities. The job characteristics (CPU bound, I/O bound), treatment time, and volume of memory used can be varied through altering the program parameters.
21. This method is suitable for measuring and comparing performance between other company's machines and own company's machines by a small number of steps
    There is need to clarify the job specifications and adopt a model close to the user's job to enable the user's use
22. simulation
23. This method has come to be used as one capable of utilization for all objectives associated with evaluation such as machine selection and improvement in prediction system efficiency
24. High precision values cannot be obtained unless even the OS itself is incorporated into the model for the simulations where large and complex machines are concerned
    It is particularly difficult when paging appears frequently
25. evaluation by monitoring
26. This method involves periodic sampling of load and state of system resources and data collecting for event generation and thereby obtain data for performance evaluation.
27. Advances in software and hardware monitors have enriched the array of tools for analysis
    This method has developed to the stage that not only improvement to performance evaluation but capability to control job scheduling has been incorporated
28. analytical method
29. Cuing [phonetic], theory and graph [phonetic] theory based mathematical models are used in the prediction of new system performance
    There are examples in EDP
30. Desk calculator estimates using delay table are effective in on-line family systems such as AIM and TSS/AIF
    Precision is poor for multiple treatment of batches and multiple paging

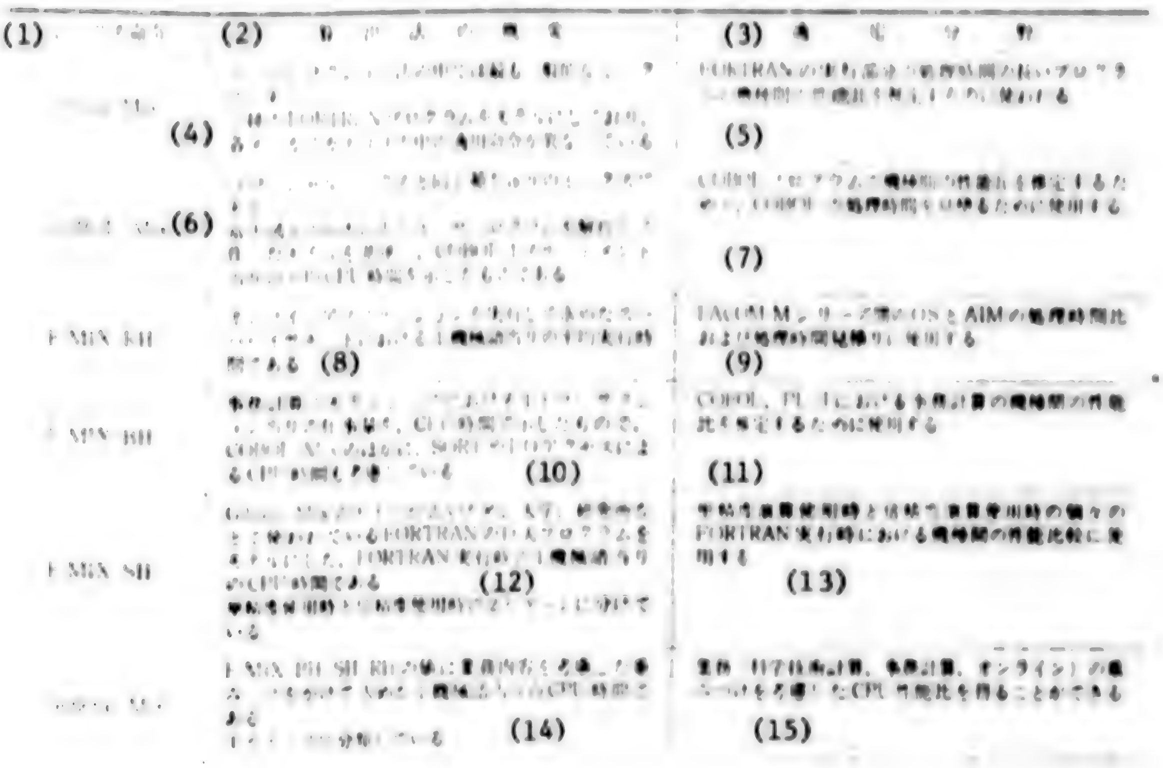
## 3.2 Evaluation Methods Used at Fujitsu

Fujitsu uses primarily the instruction mix and the kernel program methods to conduct performance comparisons between different makes of computers.

Among the evaluation methods that are used in the Gibson Mix which is used throughout the world besides which there are the F Mix and the General Mix which are based on a model that is solely intrinsic Fujitsu's. This model makes necessary changes according to a reevaluation once every several years in line with changes in computer architecture and user's program changes.

For example, where the COBOL model is concerned, any computations involving added characters or bit operation command were disregarded. Today, however, the frequency in use of these commands has increased so the capability is incorporated into the model (see Table 6)

Table 6. Outline of Evaluation Methods Used at Fujitsu



| (1) [illegible] | (2) [illegible] | (3) [illegible] |
|---|---|---|
| [illegible] | [illegible] (4) | FORTRAN [illegible] (5) |
| [illegible] | (6) [illegible] | [illegible] (7) |
| F-MIX KH | [illegible] (8) | FACOM M [illegible] OS [illegible] AIM [illegible] (9) |
| F-MIX BH | [illegible] COBOL [illegible] SORT [illegible] (10) | COBOL, PL/I [illegible] (11) |
| F-MIX SH | [illegible] FORTRAN [illegible] FORTRAN [illegible] (12) | [illegible] FORTRAN [illegible] (13) |
| [illegible] | F-MIX [illegible] (14) | [illegible] (15) |

Key:

1. mix command
2. outline of computational method
3. application area
4. This is the most general mix among the instruction methods
   There are 7 types of FORTRAN programs in the model, and the applicable commands in the various categories differ between makers
5. Used to estimate performance ratios between machines on FORTRAN programs with long treatment time in the execution section
6. Commercial mixes are treated as mixes of the same category
   Fujitsu analyzed more than 100 user programs to construct a model which is the basis for displaying average CPU time per COBOL 1 statement
7. This is used to estimate performance ratios between COBOL program machines and estimate COBOL treatment time
8. This gives the average execution time per machine language by the supervisor mode obtained from on-line application
9. Used for treatment time ratios between OS and AIM between FACOM M series and treatment time estimation

[Key continued on following page]

[Key to Table 6 continued]

10. This is the display in CPU time of the work volume per transaction in model mob for a business computation, and SORT and I/O access type times are considered in addition to MIX.
11. Used to estimate performance ratios between machines for business computations in COBOL and PL/1.
12. Because the Gibson Mix is an old model, the giant FORTRAN programs used in universities and laboratories was modeled. This is CPU time per machine language on FORTRAN time
13. Used for performance ratio comparisons between machines when a number of FORTRAN is being run for single precision and multiple precision computations.
14. This is CPU time per machine language in which the F MIX-BH/SH/RR value is weighted with the overlap taking into account business contents This is divided into four categories.
15. CPU performance ratios taking into account overlap of functions (science and technology computations, business computations, on-line) can be obtained.

## 4. System Performance Evaluation Tool

The area of greatest advances in system performance evaluation activities is the system performance evaluation tool.

The PDL/PDA (Performance Data Logger/Performance Data Analyzer) was proposed as a performance evaluation tool 6 years ago for the OS II/VS which is the OS for the FACOM "8" series computer. Since then there has been a spectacular increase in the number of tools centered on the OS IV/F4 which is the OS of the FACOM M series and the same/X8.

The PDL/PDA is the main line of the tools we suggest to users. In addition, there also are the SMF (System Management Facilities), GTF (General Trace Facilities), and STFD (Super Trace Facilities) in which charge information collection capability or trace capability have been added.

At the present time, the tools used in OS IV/F4 and OS IV/X8 total more than 50 including those used within the Fujitsu Company.

### 4.1 Range Covered by Performance Evaluation Tools

An outline of the range in information outputted by the presently available performance evaluation tools including those used within the Fujitsu Company is shown in Table 7.

## Table 7. Support Range of Performance Evaluation Tools (Outline)

| (1) [illegible] | | | (2) [illegible] | | | |
|---|---|---|---|---|---|---|
| (3) [illegible] | (4) [illegible] | (5) | [illegible] | AIM | TSS AIF | (6) [illegible] |
| (7) [illegible] | (8) [illegible] | | | | ○ | |
| | (9) [illegible] | | | | ○ | |
| CPU | (10) [illegible] | | | | — | |
| | (11) [illegible] | | ○ | | — | |
| | (12) [illegible] | | ○ | | — | |
| | (13) [illegible] | | ● | | — | |
| CM | (14) [illegible] | | ○ | | △ | |
| | (15) [illegible] | | ○ | | — | |
| | (16) [illegible] | | ○ | | — | |
| DASD MT | (17) [illegible] | | ○ | | △ | |
| | (18) [illegible] | | ○ | | — | |
| | (19) [illegible] | | ○ | | — | |
| | (20) [illegible] DASD | | ○ | | — | |
| | (21) [illegible] DASD | | ○ | | — | |
| | (22) [illegible] DASD | | ● | | — | |
| | (23) [illegible] DASD | | ○ | | △ | |
| (25) [illegible] | (24) [illegible] | | ○ | | — | |
| | (26) [illegible] | | — | ○ | | — |
| | (27) [illegible] | | ● | | — | |
| | E X C P (28) [illegible] | | | | ○ | |
| | (30) [illegible] (31) [illegible] (32) [illegible] | | | | ○ | |
| (29) [illegible] | (33) [illegible] | | | | ○ | |
| | (34) [illegible] | | ○ | | — | |
| | (35) [illegible] | | ○ | | — | |
| | (36) [illegible] | | ○ | | — | |
| | (37) [illegible] | | ○ | | — | |
| | (38) [illegible] | | | | | |
| (39) [illegible] | (40) [illegible] | | | | | |
| | (41) [illegible] | | | | ○ | |
| (42) [illegible] | (42a) [illegible] | | | | ○ | |
| | (43) [illegible] | | — | ○ | | — |
| | (44) [illegible] | | — | ○ | | — |
| | (45) [illegible] | | | | — | |
| (46) [illegible] | (47) [illegible] | | — | | ○ | — |
| | (48) [illegible] | | — | | ○ | — |
| | (49) [illegible] | | — | | ○ | — |
| | (50) [illegible] | | | — | ○ | — |
| (51) [illegible] | (51a) [illegible] | | — | | ○ | |
| [illegible] (51b) | | | | — | | ○ |

(52) ○ [illegible]

(53) ● [illegible]

(54) △ [illegible]

[Key on following page]

[Key to Table 7]

Key:

1. principal support areas
2. principal components
3. gross classification
4. small classifications
5. overall system
6. batch
7. use ratio
8. total
9. supervisor state/problem program stage
10. holding ratio
11. overlap with channel
12. time series for use rate
13. buffer heat rate
14. use rate
15. holding rate
16. time series for use rate
17. use rate
18. holding rate
19. time series for use rate
20. head transition state
21. positioning time
22. rotation retention time
23. service time
24. use rate
25. data set (file) data base
26. holding rate
27. time series for use rate
28. number of EXCP cycles
29. paging
30. number of pagings
31. total
32. by regions, by space
33. number of page reclaims
34. swapping
35. paging time
36. swapping time
37. paging time series
38. name of related module
39. memory use situation
40. size of hypothetical region
41. size of region used and time series per region or space
42. task

42a. number of tasks

43. use rate
44. holding rate
45. use rate time series
46. response time
47. overall
48. per user, per application

[Key to Table 7 continued on next page]

[Key to Table 7 continued]

49. per terminal
50. per command type
51. throughput
51a. number of treatments
51b. treatment time
52. o: item which can be measured with a performance evaluation tool
53. o: item which can be measured with a hardware monitor
54. item can be measured at the measurement environment or estimated from other data

## 4.2 Future Directions

Some representative performance evaluation tools are Fujitsu's PDL/PDA, Hitachi, Limited's VIP monitor 1, IBM's RMF (Resources Measurement Facility), and UNIVAC's SIP (Software Instrumentation Package). These are all software monitors and are collections of information on use situations of various resources, number of pagings, I/O access cycles, memory [illegible]put, and resources holding situation. One of its principal functions is to discover system bottlenecks. In addition, performance evaluation related tools operating with IBM's OS or the FACOM IV OS have been fabricated by many software houses. Some principal examples are the analytical program unitized with a hardware monitor, an analytical program based on the SMF output data and an automatic scheduling program, and a scheduling control program for referencing or altering OS control tables.

Most of these performance evaluation tools were developed in Europe and the United States, and the domestic users who utilize these programs have turned them into the same level or more readily usable tools which can better exploit OS capabilities.

Where Fujitsu is concerned, the improvement to treatment capability through dynamic scheduling control is incorporated as an OS capability. For example, the SDM (System Decision Manager) for the OS IV/F4 or the DSCF (DASD Space Control Facility) which controls the magnetic facility volume data set region can be cited here.

Some tools for which there may be demands forthcoming are the ones which can automatically handle in an efficient manner the scheduling of SMF data and a software monitor which can view a system's load situation in terms of real time.

In addition, we hope to make available in a gradual manner those tools which presently are being used in-plant mainly along the lines of response analysis tools to our users.

## 5. System Tuning Operation

Simultaneously with advances in system performance evaluation tools, there has been improvement to awareness of need for system tuning and the associated methods. This section will discuss the importance of system tuning (see Section 2.4) along with the merits and methods.

## 5.1 Importance and Merits of System Tuning

System tuning is the operation which makes possible maximizing system capabilities. The system capability is determined by the methods of operating the hardware and software together with the system. Even when the hardware is excellent, poor software or operating methods will not allow the utilization of the maximum capability of the hardware.

A system for which high rental costs are being paid may not be used as effectively as it might. This is why there is need for continuous tuning of the system to improve system performance and make possible ever greater utilization of system capabilities and lengthen system life.

The systems of the past few years have assumed very large scale and become very complex so that the system tuning effect has become a very important subject.

The number of examples of tuning of OS IV/F4 system collected at the system technology department increased roughly 30-fold between 1979 and 1980. As the same time, the "OS IV/F4 Efficient Utilization Methods" subsection of the Large System Research Association (LS Research) which is a user's association comprised of users of large Fujitsu machines is researching and discussing tuning, and some useful results are forthcoming. The importance of system tuning will increase in the future, and there probably will be greater exploitation of its advantages.

## 5.2 System Tuning Methods

Efforts are being made to keep the methods of system tuning in line with the improvements in users' awareness of SE and tuning.

The outline of tuning methods is described below. As illustrated in Fig. 1, the basic order in system tuning is repeat cycles of measurement and analysis with evaluation tools followed by the resolution of bottlenecks. The point of this bottleneck discovery is to focus on resource of high load. It is particularly important to lower the load of the magnetic disk facility, and factors responsible for this load are

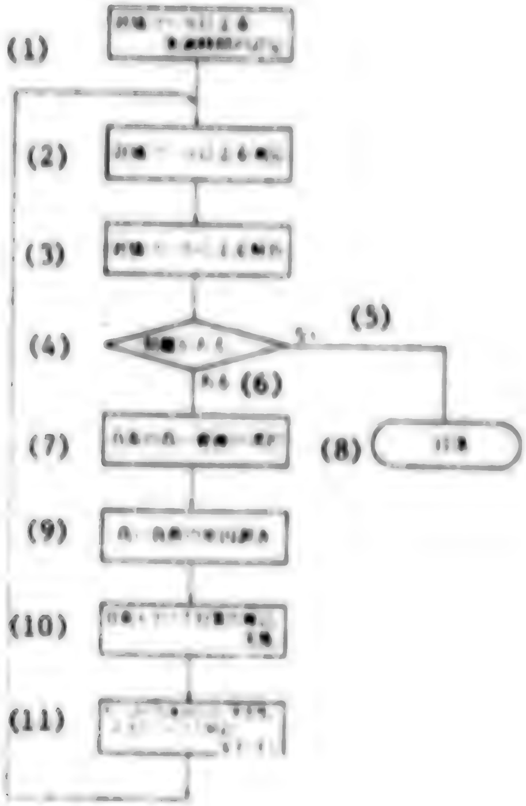
1) Frequent occurrence of paging input-output because of inadequate main memory capacity

2) Frequent occurrence of unnecessary input-output due to program design oversights

3) Accumulation of load on some specific volume

Other bottlenecks include mainly buffers for channel, task, and on-line treatment.

Figure 1. Basic Method of System Tuning



Key:

1. setting measurement time with evaluation tool
2. measurement with evaluation tool
3. analysis with evaluation tool
4. is there a problem?
5. there is no problem
6. there is a problem
7. selection of resource with high load
8. drop one stage
9. search for cause of high load
10. study and execution of countermeasures for high load
11. studies on other operating methods, degree of overlap, and hindrances; modification, execution

Among the methods of resolving bottlenecks whose removal is the main point of tuning and which has become important over the recent years is the effective utilization of main memory. The price of the main memory has undergone considerable reduction. It has now become an era in which designing the main memory in far greater scale than before in order to raise productivity and construct a system of superior performance is well within ordinary budgeted means. This is because the OS side is successively supporting capability of effective use of the main memory, and memories of readily usable nature, superior performance, and high productivity are appearing one after the other.

Some examples which can be cited here are the VIO (Virtual Input Output) of SO, resident data set of AIM, and INTERFACT with memory space.

The socalled necessary main memory capacity is gradually becoming larger, and the image of the age of high price main memory of the past is being swept away, performance utilizing main memory effectively is being raised, and revolution in consciousness of need to improve productivity is taking place.

Other methods of removing bottlenecks include the lenghthening of program length in order to reduce load on the magnetic disk facility, increasing block length, shifting and load dispersing the data set to some other volume, amking common use of programs, and converting to multitask approach.

As new functions are added to OS and new equipment is introduced, tuning methods also change. Not only wide and deep knowledge of OS is required but a sense to point of tuning must be acquired in order to conduct tuning. Tuning is difficult. On the other hand, it serves for quick adoption of materials, and it may be necessary to set up lectures related to tuning for users' benefit.

## 6. Summary

This paper has been a discussion on the present status of system performance evaluation. It may be given as a general statement that the results of activities to date which users can utilize are still very few in number. While the environment has progressed through steady and rapid equipping, this technology still remains in the realm of specialist technologists.

As area which is expected to develop from here on is the consideration of feedback from users of the software and hardware as well as the more rapid offer of tools and materials.

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CSO: 8129/1227

## SCIENCE AND TECHNOLOGY

### COUNCIL RECOMMENDS NUCLEAR ENERGY POLICY FOR 1980'S

Tokyo JAPAN PETROLEUM & ENERGY WEEKLY in English Vol 16, No 24, 15 Jun 81 pp 1,2

[Text]

On June 5, the Nuclear Energy Division of the Overall Energy Council, an advisory organ to the Minister of International Trade and Industry, submitted a recommendation to MITI Minister Rokusuke Tanaka outlining proposals for nuclear power utilization in Japan through the 1980's.

The focus of the report was on achieving means permitting Japan to extricate itself from its current overwhelming dependency on foreign supply of nuclear fuels, enrichment and reprocessing services, based on the premise that nuclear energy is to replace petroleum as Japan's foremost energy source.

According to a MITI estimate, the nuclear power generating cost (¥8-9/kwh) quite favorably compares with coal- and oil-fired thermal power generation cost (¥12-13/kwh and ¥17-18/kwh, respectively), based on a plant going onstream in 1980.

Among the targets to be established are: development, importation and stockpiling of uranium resources, gradual self-sufficiency in enriched uranium supplies, and construction of a spent nuclear fuel reprocessing plant.

(1) Japan should promote development and import of uranium resources to achieve the target for nuclear power generation of 74-78 million kw by 1995*. Japanese electric utilities have already secured supplies of 196 thousand short tons of uranium ($U_3O_8$), but additional supplies totaling 130 thousand short tons will be required by the year 2000, with an annual consumption for 2000 estimated at around 20,000 tons.

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(*) Japan now has 22 units of nuclear power reactors in operation with the combined output capacity of 15,511 MW as of June 1, 1981. This represents about 12 percent of total power generating capacity. By 1995, this percentage is to be increased to 27-28 percent, with nuclear power supplying 37-39 percent of the nation's total power supply.

At present, only 35,000 tons, i.e. 18 percent of the foregoing 196,000 tons, will be supplied from overseas projects in which Japanese enterprises are participating, with the remainder to be supplied by straight imports from Canada, U.K., South Africa and Australia. It is now urged to increase this 18 percent to more than 50 percent in the future.

(2) **Japan should achieve 30 percent self-sufficiency in its enriched uranium supplies, with a prototype plant (having a capacity of 200-250 tSWU*/year) and then a commercial plant (reaching a capacity of 3,000 tSWU/year) by the year 2000.**

Japan now entirely relies on the U.S. Dept. of Energy and Eurodif in France for enriched uranium supplies to cover operation of up to about 59 million kw.

Japan's first uranium enrichment pilot plant went onstream in September 1979 at Ningyo Pass, Okayama Pref. With the completion of the third-phase project now scheduled this fall, the pilot plant (with 7,000 units of centrifuges) is expected to supply 70 tSWU of enriched uranium (3.2 percent) per year.

A feasibility study has been under way for a Japan-Australia joint project for uranium enrichment in Australia.

(3) **The government is urged to support the plan for construction of a 1,200-ton-per-year private nuclear fuel reprocessing plant for operation by around 1990.** A new private company, Japan Nuclear Fuel Service Co., Ltd., was established in March 1980 to expedite the plan.

Japan's reprocessing of spent nuclear fuel is now being carried out by British and French companies on a long-term contract basis.

Japan's own first reprocessing pilot plant went onstream in September 1977 in Tokai-mura, Ibaraki Pref., in accordance with the Japan-US agreement for reprocessing 99 tons by September 1979. However, the two governments later agreed at a number of times to extend the period of operation of the plant beyond September 1979, with the latest agreement calling for extension of the period to the end of October 1981 for reprocessing 149 tons (instead of 99 tons).

(4) **Japan should build up a stockpile of a year's supply of uranium — either in the form of natural uranium ($U_3O_8$) or enriched uranium ($UF_6$, $UO_2$, etc.).**

Following receipt of the recommendation, MITI is expected to lend its support to the various taxational and fiscal policy measures required to achieve the goals outlined.

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(*) Separative Work Unit. A 1,000 MW nuclear power plan requires enrichment services of 110 tSWU per year.

CSO: 4120/267

## NATION'S DEPARTURE FROM OIL MORE DRASTIC THAN EXPECTED

Tokyo JAPAN PETROLEUM & ENERGY WEEKLY in English Vol 16, No 24, 15 Jun 81, pp 3-5

[Text]

**Japan's oil conservation in calendar 1980 totaled 41.54 million kiloliters (714 thousand barrels per day; TBD) in crude oil equivalent*, according** to a survey report released on May 21 by the Natural Resources and Energy Agency (NREA) of the Ministry of International Trade and Industry (MITI).

**Significantly departing from the pattern in previous years, Japan's oil consumption in 1980 dropped 9.9 percent from 1979, while the gross domestic product (GDP) and the industrial production in terms of the mining and manufacturing index are estimated to have increased 4.4 and 7.0 percent, respectively.** This means that the oil consumption-GDP elasticity factor turned negative, for the first time in five years. Meanwhile, the fuel oil consumption-mining/manufacturing index elasticity factor has been negative since 1978, but the factor became greatly depressed in 1980.

The survey discloses that:

- Japan's theoretical oil consumption in 1980, as computed using the "Inter-Industry Relations Table" method, should have been 290.78 million kiloliters (4,997 TBD).

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(*) Crude oil equivalent There are two ways of converting oil products including LPG to "crude oil equivalent" figures. One is to convert all "kiloliters" to "tons," using specific gravities of individual products, which are then converted back to "kiloliters in crude oil equivalent," using the specific gravity of crude oil — MITI uses a factor of 0.8550 for this purpose. When discussing Japan's oil imports (including LPG), MITI employs this method (see JPEW Vol.16, No.22, dd. June 1, 1981 - p.8).

Another way is to convert all "kiloliters, $m^3$ and/or tons" to "kilocalories," using heating values of individual products, which are then converted back to "kiloliters in crude oil equivalent," using the heating value of crude oil — MITI uses a factor of 9,400 kcal/liter for this purpose.

- However, the actual consumption was 249.24 million kiloliters (4,283 TBD).

- This means that the conservation of oil totaled 41.54 million kiloliters (714 TBD), or 14.3 percent. The oil saving of this magnitude was made possible as a result of composite factors listed below:

  - oil saving efforts on the part of consumers due primarily to ever increasing oil prices,
  - conversion from oil to other alternative energy sources, again due to mounting oil prices,
  - directional change in the industrial structure toward a less energy consuming type,
  - improvement in the "flood factor" in 1980, resulting in increased hydraulic power output,
  - improvement in the rate of nuclear power reactor operation, and
  - unseasonably cool summer in 1980, resulting in a decrease in electric power consumption.

- The foregoing 41.54 million kiloliters of oil saving breaks down into:

| . manufacturing industries | oil product | oil conservation (million kl/year) |
|---|---|---|
| ceramic/porcelain | fuel oil | 3.77 |
| iron & steel | fuel oil | 2.89 |
| chemical/petrochemical | fuel oil | 1.04 |
| | naphtha | 0.85 |
| textile | fuel oil | 1.07 |
| paper & pulp/nonferrous | fuel oil | 1.01 |
| other | fuel oil | 1.71 |
| reduction in oil consumption resulting from reduced refinery product output | fuel oil | 2.00 |
| subtotal | | 14.34 |

| | | |
|---|---|---|
| . energy supply industries | | |
| electric power industry - | | |
| oil replaced by: | LNG | 3.74 |
| | improvement in "flood factor" | 1.66 |
| | improvement in nuclear power | 5.50 |
| | coal | 0.72 |
| | | 11.62 |
| city gas industry - | | |
| oil replaced by: | LNG | 0.86 |
| | coal | 0.23 |
| | | 1.09 |
| subtotal | | 12.71 |
| . other industries (i.e. agricultural/forestry/fishery industries, transportation, construction, etc. industries and household/commercial sector) | | 14.49 |
| | | 41.54 |

Memo:

(1) In the iron & steel industry, the number of non-oil blast furnaces increased from 6 units at the end of 1979 to 30 units at the end of 1980, meaning that 68.2 percent of Japan's total blast furnaces converted to "oil-less" operations.

(2) In the cement industry, the coal consumption as percentage of total fuel consumption increased from 7.4 percent in 1979 to 30.9 percent in 1980, and 53.1 percent in the October-December 1980 period. Meanwhile, the number of kilns converted for coal consumption increased from 35 units at the end of March 1980 to 100 units at the end of December 1980, meaning that 51.5 percent of Japan's total kilns converted to coal consumption.

Shown below is Japan's oil consumption in calendar 1980:

| | 1,000 Kl | Million Kcal | Crude Oil Equivalent (1,000 Kl) |
|---|---|---|---|
| Gasoline | 34,615 | 297,689,000 | |
| Naphtha | 28,365 | 243,939,000 | |
| Jet fuel | 2,989 | 26,602,100 | |
| Kerosine | 23,450 | 208,705,000 | |
| Gas oil | 21,502 | 197,818,400 | |
| Fuel oil A | 21,263 | 210,503,700 | |
| Fuel oil B | 5,638 | 55,816,200 | |
| Fuel oil C | 77,262 | 764,893,800 | |
| | 104,163 | 1,031,213,700 | |

|  | 1,000 Tons |  |  |
|---|---|---|---|
| LPG | 14,932 | 179,184,000 |  |
| Subtotal |  | 2,185,151,200 | 232,463 |
| Crude oil burning |  | 157,685,000 | 16,775 |
| Total |  | 2,342,836,200 | 249,238 |

CSO: 4120/267

## MHI NAMED PRIME CONTRACTOR FOR AIM-9L PRODUCTION

Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 pp 2-3

[Text]

The Japan Defense Agency (JDA) has named Mitsubishi Heavy Industries Ltd. (MHI) as prime contractor for license production of the Raytheon/Ford Aerospace & Communications (FACC) AIM-9L Sidewinder air-to-air missile for the F-15 fighter.

The JDA intends to exchange a new memorandum of understanding (MOU) with the U.S. government for license production of the missile as early as possible. The new MOU is necessary for Japan's use of the infrared-guided missile for the F-4EJ fighter as well as the F-15 for the Air Self-Defense Force (ASDF).

MHI is to select subcontractors while going ahead with final negotiations with Raytheon on a licensing contract. It is expected to seek the government's approval of the contract possibly in July.

The United States, at talks with the JDA in June 1980, agreed to release the AIM-9L's warhead, rocket motor, safety system and other components in FY 1981 and the guidance and control section in October 1982 for Japanese license production, though it declined to release the active-optical-target-detector (AOTD). As a result, the JDA has decided to subject 171 AIM-9Ls funded in FY 1981 and their followers to domestic license production. The first AIM-9Ls funded in FY 1980 were imported under a foreign military sales (FMS) contract with the U.S. Air Force Department.

AIM-9L production proposals had been submitted by Toshiba Corp. (teaming up with FACC) and Mitsubishi Electric Corp. (Raytheon and FACC) as well as MHI (Raytheon). The JDA selected MHI apparently in consideration of its past experience in the production of other infrared-guided AAMs.

The JDA's AIM-9L procurement is expected to total more than 3,000 units because the ASDF plans to order F-15Js beyond the currently authorized 100 aircraft and use the missiles to upgrade performance of its F-4EJs.

As to the 171 AIM-9Ls (worth ¥5,440 million) funded in FY 1981, guidance and control sections will still be imported under an FMS contract along with AOTD systems. The sections for AIM-9Ls to be funded in FY 1982 will be produced under license as agreed by the U.S. government.

CSO: 4120/264

# MHI ADVANCING INFANTRY VEHICLE DEVELOPMENT FOR GROUND FORCES

Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 p 3

[Text]

Mitsubishi Heavy Industries Ltd. (MHI) is advancing development of a mechanized infantry combat vehicle (MICV) for the Ground Self-Defense Force (GSDF) under a contract with the TR&DI.

In the current fiscal year, it is to fabricate the chassis of the MICV after the turret in FY 1980. The TR&DI earmarked ¥110 million for the turret and ¥1,060 million for the chassis. The TR&DI and MHI plan the MICV program to enter the full-scale stage with fabrication of the comprehensive system in FY 1983, expecting completion of the program around FY 1987.

The MICV will be manned by nine to 10 troops for joint operation with tanks. It will be armed with 25-30mm machine guns and antitank missiles so that crewmen can engage in combat without getting off. In case of the existing Model 60 and 73 armored personnel carriers (APC), crewmen must get off the vehicles for actual fighting.

It is the first time that Japan is developing an MICV on its own, although the United States and other foreign countries have already developed such vehicles.

MHI intends to proceed with development of the MICV and a new main battle tank, named the Model 88 (FY 1988) MBT tentatively, almost simultaneously as is the case with the past development of tanks and APCs. For example, the Model 60 and 73 APCs were developed for service entry in FYs 1960 and 1973, respectively, only one year before the Model 61 and 74 tanks.

MICVs will be initially deployed for the GSDF Seventh Division in Hokkaido. Later, they will gradually replace about 600 outmoded APCs. The GSDF forcasts that the MICV may be priced at half of the Model 88 MBT cost.

CSO: 4120/264

## ENGINE FOR NEW 150-SEAT AIRLINER READY IN JANUARY

Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 p 4

[Text]

Rolls-Royce and Japanese Aero Engines Ltd. is finalizing the design of the RJ500, a new technology and energy efficient turbofan to power the next generation of 150-seater airliners. It is planned to enter service in 1986.

The high pressure core section of the engine will be tested in October this year and work in Japan and the UK to produce the first two bench demonstrator engines is on schedule. The first, designated RJ500-01, is planned to begin test running at the end of next January at Rolls-Royce's Bristol plant. The second will run at Ishikawajima-Harima's Mizuho plant near Tokyo by mid-March.

Engine tests will begin only two years after the first Japanese engineers and designers arrived in Bristol to join their counterparts from Rolls-Royce in the task of designing an engine for short to medium-haul aircraft for service from the mid-1980s.

The new 150-seater airliners are expected to need engines of around 25,000 lb thrust and the RJ500 has been designed to meet these needs. The core is also suitable for an engine of lower thrust for possible new 130-seater airliners. The engine is being considered as the powerplant for these aircraft both by potential airline customers and the airframe makers. It is expected to become a major Anglo-Japanese program and one which will last well into the next century.

The costs of the present development work is being shared equally between Rolls-Royce on the one hand, and the three Japanese companies - Ishikawajima-Harima, Kawasaki and Mitsubishi - who are partners in the joint company. The Japanese comparies are responsible for the engine's low pressure spool, accessories and dressings, and Rolls-Royce for the high pressure spool, combustion section and accessory gearbox. Rig testing of components is well underway.

Two further compressor rig tests are in hand at Bristol, a nine-stage full-scale high pressure module and a half-scale compressor. A third test has recently been completed on the high pressure turbine rig. A new fan test facility is about to be commissioned in Japan for further fan testing to augment the work already carried out at Bristol. A half-scale low pressure rig, designed and manufactured in Japan, has also been run.

CSO: 4120/264

## TALKS WITH FOREIGN FIRMS ON Y-XX RESUME

Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 p 2

[Text] Japan's aircraft industry is expected to resume negotiations with foreign aircraft manufacturers soon to select partners for its program for developing a new 150-seater fuel-efficient commercial transport, coded here as the Y-XX.

In July or August, representatives of Fokker and McDonnell Douglas will visit Japan to brief the Japanese industry on their joint development of an aircraft similar to the Y-XX, according to the Ministry of International Trade and Industry (MITI).

Negotiations with other candidate partners such as Boeing Co. and Airbus Industrie will follow suit.

As to the Y-XX program, MITI has earmarked loans in the FY 1981 budget for preliminary engineering and market survey.

Meanwhile, industry observers expect that full-scale development of the Y-XX would be launched around 1984. This is because new fuel-efficient engines, including the Rolls-Royce/Japan RJ500, for such aircraft are expected to be developed by 1985. At present, there is only one appropriate engine, the General Electric/Snecma CFM56.

Even if the new transport is developed earlier, U.S. airlines, seen as promising users would not be able to introduce it because of their current poor business performance. They may continue to fly DC-9 Super 80s and Boeing 737-300s for the time being.

In case an appropriate engine is developed by 1985 with airframe development launched in 1984, the new transport would take two years to receive a type certificate. Thus, debut of the new transport with new engines is expected in 1987 or 1988, Japanese industry sources say.

CSO: 4120/273

## FULL-SCALE XSSM-1 DEVELOPMENT TO START IN FY 1982

Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 pp 7-8

[Text]

The Technical R&D Institute (TR&DI) of the Defense Agency expects to start full-scale development of the Ground Self-Defense Force's (GSDF) XSSM-1 ground-launched antiship missile, a modified version of the ASM-1 air-launched antiship missile for the Air Self-Defense Force, in FY 1982.

It may earmark ¥9,000 million in the FY 1982 budget request in late August for the first-phase fabrication of full systems in FY 1982 and 1983 after fabrication of key component parts ending in the current fiscal year. The second-phase fabrication is planned for FY 1983-84.

The new missile is expected to undergo technical tests in FY 1985 and the GSDF's application tests in FY 1986 before procurement starting in FY 1987.

The TR&DI has conducted basic research on such component parts as the propelling system, homing head, inertial system and booster rocket motor since FY 1979.

Meanwhile, the TR&DI also plans to launch engineering development of a new main battle tank simultaneously with the XSSM-1 program in FY 1982. The Defense Agency, however, would have to make a bold decision on the simultaneous start of both of these programs for the GSDF.

CSO: 4120/273

## TR&DI TO REQUEST BK-117 FOR TESTING MISSILES

Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 p 8

[Text]

The Technical R&D Institute (TR&DI) of the Defense Agency plans to purchase a BK-117 multi-mission helicopter (under development jointly by Kawasaki Heavy Industries and MBB) for testing missiles in FY 1982, as full-scale engineering tests of the SSM ground-launched antiship, portable surface-to-air, Chu-MAT antitank and other new missiles are scheduled for FY 1983-85.

In the FY 1982 budget in late August, it is expected to seek a total of ¥550 million for the medium-size twin-turbine helicopter, testing equipment, spare parts and other equipment as well as for training.

The TR&DI had proposed procurement of an aircraft exclusively for testing missiles under the FY 1981 budget. But the agency failed to incorporate the proposal into its FY 1981 budget request because some quarters insisted that it was premature to possess such equipment. At present, however, the agency is said to acknowledge the increasing necessity of the aircraft with a view to promoting the defense research and development setup.

The TR&DI has chosen a helicopter rather than a fixed-wing plane as the testing aircraft because its characteristic capability of hovering over a certain point may be suitable for observing firing tests of missiles. Specifically, the testing aircraft will be used for telemetering test data and confirming hits.

CSO: 4120/273

## SCIENCE AND TECHNOLOGY

### NIPPON OILS, FATS COMPANY DEVELOPING NITRAMINE PROPELLANT

Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 pp 9-10

[Text]

Nippon Oils & Fats Co.,a manufacturer of solid rocket propellant, has started development of solid nitramine composite propellant which would improve the performance of satellite-launching rockets.

It has already successfully tested a rocket motor for military use with such propellant. The firm expects that it could gain the world's most advanced technology for solid rocket propellant through application of the propellant to satellite-launching rockets.

The traditional composite propellant consists of oxidizer, ammonium perchlorate and synthetic resin. In the new propellant, the ammonium perchlorate is replaced by nitramine.

Nitramine, a highly explosive material. has never been used for rocket propellant in Japan. But it has been found that if combustion is controlled well, nitramine could be useful for upgrading rocket performance. Fox example, if a certain amount of the traditional propellant can boost a rocket for 245 seconds, the same amount of the new propellant would be able to boost it for around 250 seconds. Furthermore, the smokeless nitramine does not pollute the air, though the traditional propellant produces hydrogen chloride gas which reacts on water vapor to turn out hydrochloric acid mist.

The company intends to use the low-pollution nitramine composite propellant for the upper-stage spherical motor of the H-1 rocket which Japan plans to develop to launch large satellites.

CSO: 4120/273

## JAPAN, USSR TO JOINTLY PROMOTE SAKHALIN LNG PROJECT

Tokyo JAPAN PETROLEUM AND ENERGY WEEKLY in English Vol 16, No 27, 6 Jul 81 pp 1-5

[Text]

An agreement has been reached between Japan and the Soviet Union that gas production from the Chaivo structure of the northeastern part of the Sakhalin continental shelf will be liquefied and supplied to Japan as LNG (along with 50 percent of oil production) at an annual rate of three million tons over a 20-year period beginning 1988, it was announced on June 30 by the Tokyo-based Sakhalin Oil Development Cooperation Co., Ltd. (SODECO). (See note below.)

A bilateral meeting has been under way in Tokyo since June 18 between SODECO representatives and visiting Soviet officials represented by V.N. Sushkov, Deputy Minister of the Foreign Trade, and Y. V. Zaitsev, First Deputy Minister of the Gas Industry. The Japan-Soviet meeting confirmed that:

(1) A master plan for commercial development and production of gas from the Chaivo structure and the LNG supply to Japan has been agreed to as summarized below:

- Drilling of appraisal wells will be completed by the end of 1981, to be followed by estimation of gas reserves and finalization of commercial development and production plans by the fall of 1982.

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Note: Japan originally wanted to receive the gas through a pipeline, based on the assumption that consumption in Hokkaido is large enough to absorb the entire volume for distribution within the island. However, a survey by the Hokkaido Natural Gas Receiving Promotion Committee recently disclosed that gas consumption in Hokkaido will total only 300 million $m^3$ per year (i.e. 200 thousand tons per year) in 1985, far below the Soviet Union's supply target. Accordingly, the plan for receiving the Sakhalin gas through a pipeline had to be dropped, leaving no other choice but to receive the gas in the form of either LNG or methanol. In the absence of firm markets for methanol today, the only alternative is to import the gas as LNG.

- Construction of the first production platform will be started around the middle of 1982 for completion by the fall of 1985, to be followed by construction of the second and third platforms. Upon the completion of the first platform, drilling of production wells will be started.

- A technical feasibility study on the LNG project will be started immediately for construction of the plant facilities to be started in 1984 for completion by the end of 1987.

- Full-fledged production of LNG (and oil) will be started in 1988.

- Further details will be discussed at a working-level meeting scheduled in July.

(2) While the Soviet side newly proposed De-Kastri on the Littoral Province of Siberia as one of the most promising sites for the LNG plant, the Japanese side failed to agree to the proposal. The two parties decided to make further studies on the location of the LNG plant and the loading port, taking into account the weather and maritime conditions, port conditions, etc., as well as the preferences of Japanese LNG users, i.e. electric and gas utilities. (Editor's note: The Soviet side originally proposed that the LNG plant should be built at Ilinsky on the southwestern coast of the Sakhalin Island.)

(3) **It has been agreed that funds required for gas production from the Chaivo structure for supply to Japan as LNG will be the subject of Japan's provision of bank loans** (i.e. from the Export-Import Bank of Japan and Japanese city banks at an approximate ratio of 70:30 in favor of the former to the Soviet Foreign Trade Bank) in accordance with the basic agreement (dated January 28, 1975). (Editor's note: While the basic agreement stipulates that Japan will provide up to 50 percent of the oil/gas development funds, it remains to be seen to what extent the Japan Ex-Im Bank agrees to extend loans to finance the entire project including the liquefaction of gas. No estimated total cost is available at this moment, since the location of the LNG plant has not been finalized yet.)

The Japan-USSR joint oil and gas exploration in the Sakhalin continental shelf was first proposed by the Soviet Union at the fifth Japan-Soviet Economic Committee meeting held in Tokyo in February 1972, and SODECO was established in Tokyo on October 1, 1974, for the purpose of promoting the project, with the government-owned Japan National Oil Corp. (JNOC) providing 70 percent of total funds required for carrying out the exploration.

The joint venture has been under way since 1976, with the Soviet Union actually carrying out the exploration according to the timetable drawn up by the joint committee, consisting of an equal number of technical specialists representing each side.

During the period from August 1977 through October 1980 a total number of 13 exploratory wells have been drilled as shown on page 4 -- 10 wells on the northeastern continental shelf (44,800 $km^2$, 17,300 sq mi) and 3 wells on the southwestern continental shelf (16,000 $km^2$, 6,180 sq mi). Of the 10 wells drilled on the northeastern continental shelf, three wells confirmed the existence of promising oil and gas reservoirs off Chaivo and five wells confirmed the same off Odopto.

Drilling of two wells - Chaivo #3 and Odopto #4 - have just been started and that of Chaivo #5 will be started later in the year to facilitate appraisal of oil and gas reserves of the foregoing two structures.

SODECO has so far pledged to extend $170 million credits -- $100 million originally pledged in the basic agreement dated January 28, 1975, and $70 million additionally agreed in the addendum dated June 6, 1979 -- to complete the exploration. These credits, to be used in the initial 7 years, carry an annual interest rate of 6 percent and are repayable in 18 years, and furthermore, are on a "repayble if successful" risk-taking basis. These funds have been and will be raised in the form of capital investment in and loan extension to SODECO by JNOC and private firms participating in the Sakhalin project. Within the framework of these credits, Japan is to lease a geophysical exploration ship and drilling equipment, while supplying exploration materials and services.

According to the basic agreement, the credits, including interests, are to be refunded with oil and/or gas developed within 18 years after the exploration was started, as follows:

- oil - 50 percent of the total output
- gas - to be determined bilaterally, evaluating the profitability of sales to Japan

The guarantee for supply to Japan is to be afforded throughout the period repayment of the credits/interests is in progress and 10 years after the repayment is completed. Moreover, in return for credits on a "repayable if successful" basis, the Soviet Union is to apply an 8.4 percent discount rate on oil and gas supplies to Japan for 10 years after the production has started.

In addition to the foregoing extension of credits, SODECO has provided the following two loans to the Soviet Union:

- A loan totaling ¥6,740 million ($29 million) to help finance purchases of durable equipment, including computers to be taken aboard the geophysical exploration ship. The loan, to be used in the 3-year period and carrying an annual interest rate of 6.75 percent, was provided by a syndicate of Japanese banks, and is repayable in ten equal six-month installments.

- A loan totaling ¥8,980 million ($39 million) to help finance operating expenses. The loan, to be used in the 3-year period and carrying an annual interest rate of 7.25 percent, was provided by JNOC and a syndicate of Japanese banks, and each year's loan/expenditure is repayable in ten equal six-month installments.

The present plan calls for production of natural gas and condensate, as shown below:

| | 1988 | 1989 | 1990 | 1991-2008 | Total/Average |
|---|---|---|---|---|---|
| . Natural gas: | | | | | |
| million m³/year | 2,580 | 4,050 | 5,030 | 5,050 | 102,560 |
| million ft³/day | 249 | 392 | 486 | 488 | 472 |
| million tons/year (shipment basis) | 1.4 | 2.1 | 3.0 | 3.0 | 60.5 |
| . Condensate: | | | | | |
| thou.kl/year | 278.7 | 427.9 | 534.7 | 536.3 | 10,895 |
| thou. b/d | 4.8 | 7.4 | 9.2 | 9.2 | 8.9 |

Assuming the LNG plant at Ilinsky, which is 1,800 km* (1,120 miles) away from Tokyo, either two LNG carriers having a loading capacity of 125,000 m$^3$ each or three carriers of 75,000 m$^3$ each will be necessary.

Shown below are the results of the wells drilled on the Sakhalin continental shelf:

| Well | Location | Drilling Period | | Depth | | Results | Rig Used |
|---|---|---|---|---|---|---|---|
| | | Started | Completed | Meters | Feed | | |
| Northeastern Continental Shelf | | | | | | | |
| . Odopto #1 | 53°18'25" N<br>143°18'00" E | Aug. 3, 1977 | Oct.13, 1977 | 2,500 | 8,200 | Successful | Borgsten Dolphin |
| . Odopto #2 | 53°12'20" N<br>143°23'17" E | Jul.16, 1978 | Aug. 29, 1978 | 2,348 | 7,701 | Successful | Borgsten Dolphin |
| . Odopto #3 | 53°15'00" N<br>143°19'06" E | Sept.3, 1978 | Oct.15, 1978 | 2,274.5 | 7,460 | Successful | Borgsten Dolphin |
| . Odopto #9 | 53°19'22" N<br>143°27'03" E | Jul.14, 1978 | Aug.20, 1978 | 2,293 | 7,521 | Dry | Hakuryu #4 |
| . Wenin #1 | 51°42'51" N<br>143°27'03" E | Aug.24, 1978 | Oct.13, 1978 | 2,505 | 8,216 | Dry | Hakuryu #4 |
| . Chaivo #1 | 52°25'46" N<br>143°27'44" E | Jul.5, 1979 | Oct.18, 1979 | 3,378 | 11,080 | Successful | Hakuryu #4 |
| . Odopto #8 | 53°05'40" N<br>143°27'50" E | Jul.20, 1979 | Aug.28, 1979 | 1,865 | 6,117 | Successful | Hakuryu #2 |
| . Chaivo #2 | 52°23'21" N<br>143°27'45" E | Jul.28, 1980 | Oct.3, 1980 | 2,855 | 9,364 | Successful | Hakuryu #2 |
| . Chaivo #4 | 52°24'46" N<br>143°27'35" E | Sept.4, 1980 | Oct.24, 1980 | 2,080 | 6,822 | Successful | Okha |
| . Dagi #1 | 52°21'28" N<br>143°50'35" E | Sept.9, 1979 | Oct.24, 1980 | 3,034.9 | 9,954 | Dry | Hakuryu #2 |

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(*) This distance favorably compares with 4,450 km for Badak-Tokyo, 6,000 km for Arun-Tokyo, 6,000 km for Alaska-Tokyo, and 11,900 km for Abu Dhabi-Tokyo.

| Well | Location | Drilling Period |  | Depth |  | Results | Rig Used |
|---|---|---|---|---|---|---|---|
|  |  | Started | Completed | Meters | Feed |  |  |
| **Southwestern Continental Shelf** |  |  |  |  |  |  |  |
| . Staromajachin #1 | 47°59'00" N<br>141°43'00" E | Nov.1, 1977 | Jul.3, 1978 | 3,016 | 9,892 | Dry | Borgsten Dolphin |
| . Kuznetzovo #1 | 46°08'20" N<br>141°40'57" E | Apr.21, 1978 | Jul.3, 1978 | 3,013 | 9,883 | Dry | Hakuryu #4 |
| . Vindiz #1 | 46°11'00" N<br>141°46'00" E | Oct.22, 1978 | Jun.24, 1979 | 3,400 | 11,152 | Dry | Hakuryu #4 |

SODECO is currently capitalized at ¥22,700 million (approx. $100 million) and its 18 shareholders' equity shares are shown below:

|  | ¥ Million | % Share |
|---|---|---|
| Japan National Oil Corp. | 9,700 | 42.7 |
| Overseas Petroleum Corp. | 2,347.5 | 10.3 |
| Japan Petroleum Exploration Co. | 2,347.5 | 10.3 |
| C. Itoh & Co. | 1,740 | 7.7 |
| Gulf Oil Corp. | 1,300 | 5.7 |
| Fuyo Petroleum Development Co. | 1,170 | 5.2 |
| Marubeni Corp. | 520 | 2.3 |
| Daikyo Oil Co. | 325 ) | 15.8 |
| Idemitsu Kosan Co. | 325 ) |  |
| Kyodo Oil Co. | 325 ) |  |
| Kyushu Oil Co. | 325 ) |  |
| Maruzen Oil Co. | 325 ) |  |
| Kanematsu-Gosho Co. | 325 ) |  |
| Sumitomo Corp. | 325 ) |  |
| Toyo Menka K.K. | 325 ) |  |
| Nissho Iwai Co. | 325 ) |  |
| Nichimen Jitsugyo Co. | 325 ) |  |
| Sakhalin Natural Gas Development Cooperation Public Corp. | 325 ) |  |
|  | 22,700 | 100.0 |

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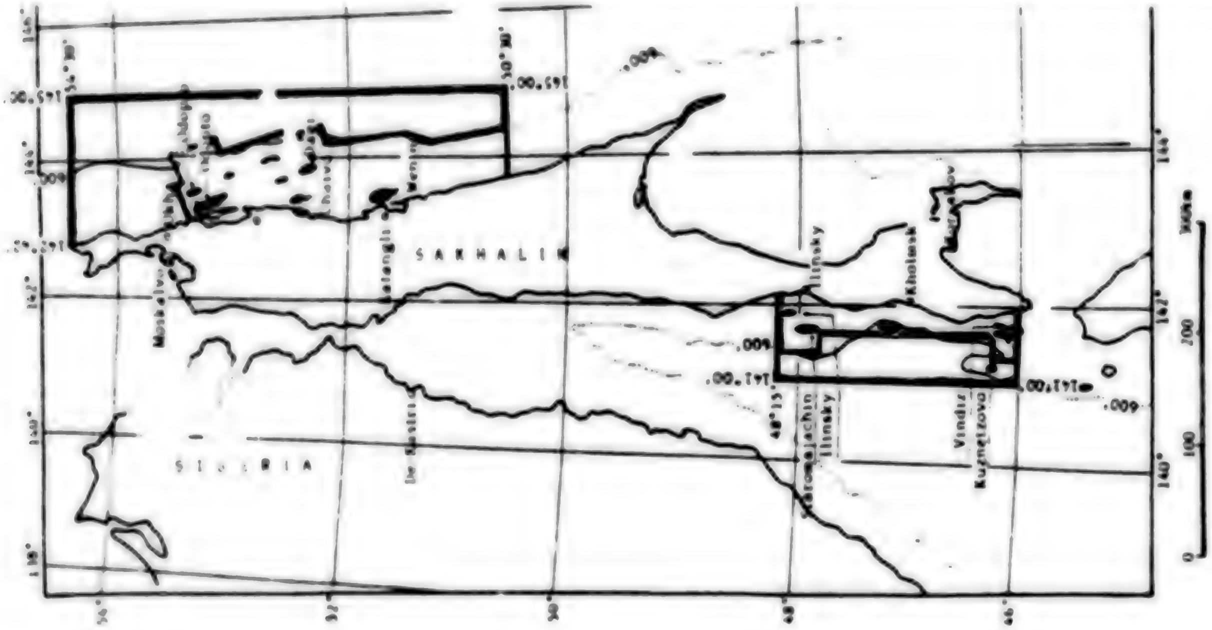


CSO: 4120/281

## SCIENCE AND TECHNOLOGY

# JOINT METHANOL VENTURES WITH SAUDI ARABIA DESCRIBED

Tokyo LOOK JAPAN in English Vol 27, No 304, 10 Jul 81 p 18

[Article by Tameyoshi Tsuchiya, Economic Cooperation Division, Ministry of International Trade and Industry]

[Text] The Japanese government has pledged to provide government-based aid for the Saudi petrochemical development plan, in continuation of Japan's commitment to economic cooperation with Saudi Arabia in that country's methanol project.

Two projects have been selected for emphasis. Through these Japan hopes to contribute actively to the industrialization and economic development of Saudi Arabia.

### Japan-Saudi Economic and Technical Cooperation

For a long time, Japan and Saudi Arabia have had close economic relations in oil, trade, and economic and technical cooperation. In March 1975, Japan concluded with Saudi Arabia the "Agreement on Economic and Technical Cooperation between the Government of Japan and the Government of the Kingdom of Saudi Arabia." With the agreement, Japan firmly announced its intention to cooperate with Saudi Arabia in its nation-building efforts. In line with this decision in methanol, petrochemical, seawater desalination, and other projects, Japan intends to continue to contribute to the country's industrialization policy, thus promoting economic and technical cooperation with technical transfers as the nucleus.

### Important Factors in Cooperation

**(1) Cooperation for industrialization**

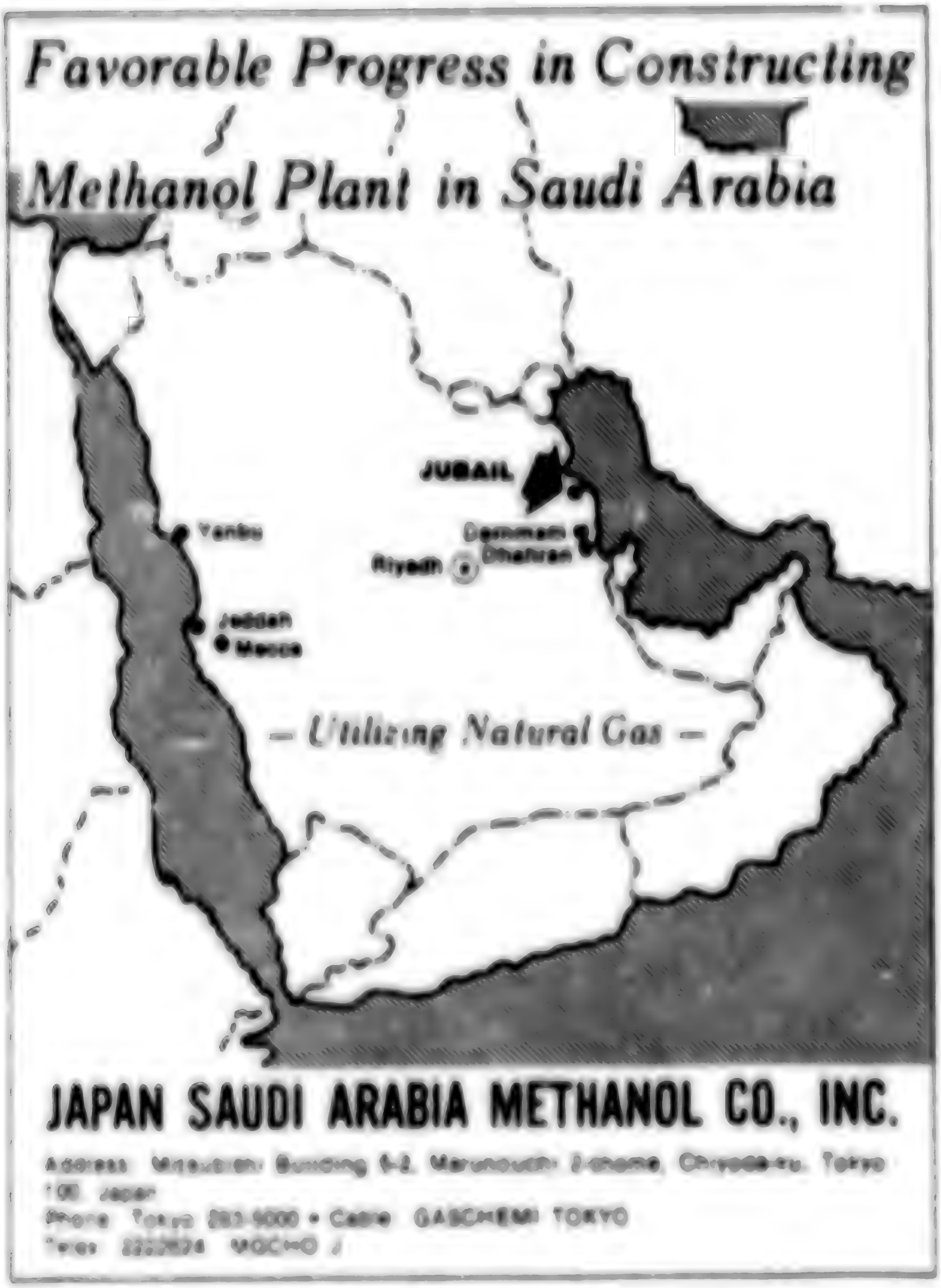
To break away from over-reliance on oil exports, Saudi Arabia is actively seeking cooperation from industrialized countries in promoting methanol and petrochemical production, as well as steel and aluminium refining, fertilizer production, and other industrial areas where Saudi Arabia, because of its fuel resources, has a strong comparative advantage. Countries and enterprises which cooperate in these fields will receive priority in oil supplies, Saudi Arabia has announced.

The Japan-Saudi Arabia joint ventures in methanol and petrochemicals are two of the most significant large-scale industrial projects now taking place in Saudi Arabia. They are included in Saudi Arabia's third 5-year development plan.

Because the operation of both complexes will be turned over to Saudi technicians upon completion, quite a number of Saudi Arabians will need to come to Japan for training and Japanese technical specialists will also be dispatched to Saudi Arabia. To effect these exchanges, Japan is cooperating in the human development sections of Saudi Arabia's industrialization plan.

**(2) International political significance**

Saudi Arabia is the leader of the Arab moderates, and as such wields considerable leadership not only in the Middle East and Africa but in the world economy as well. Thus for Japan and the West, as members of the free world industrial bloc, close cooperation with


Favorable Progress in Constructing
Methanol Plant in Saudi Arabia
JUBAIL
Yanbu
Dammam
Dhahran
Riyadh
Jeddah
Mecca
– Utilizing Natural Gas –

JAPAN SAUDI ARABIA METHANOL CO., INC.
Address: Mitsubishi Building 5-2, Marunouchi 2-chome, Chiyoda-ku, Tokyo 100, Japan
Phone: Tokyo 283-5000 • Cable: GASCHEMI TOKYO
Telex: 2222924 MGCHO J

Saudi Arabia in its nation-building efforts is important not only for maintaining and strengthening friendly bi-lateral relations but for the stable economic development of the entire world.

(2) Significance to energy policy

Saudi Arabia, the world's largest oil producer, is pursuing a policy of steady production, pricing, and exports of oil, which contributes greatly to the health and stability of the world economy. The money gained from oil is not only fed into 5-year and other plans for Saudi Arabia's development, but is also being used for aid to the developing countries. Thus Saudi Arabia's wealth serves to promote domestic and international stability and socio-economic development.

Oil from Saudi Arabia has played a significant part in Japan's economic and technological growth, and so Japan is striving to help Saudi Arabia's development through economic and technical cooperation, and the transfer of technology.

Saudi Arabia has promised to supply incentive crude oil in return for cooperation in human development, technology, management, sales, and financing for important industrial projects. Saudi Arabia has publicly promised to supply incentive crude oil in return for Japanese cooperation in the petrochemical project in addition to the on-going methanol project. The projects thus have great significance for the future security of Japanese oil supplies.

## Present State of Two Joint Venture Undertakings

The methanol and petrochemical projects both seek to tap previously unused Saudi Arabian resources to produce petrochemicals. Both are being carried out by private industry with the financial cooperation of the Japanese government. Thus both are regarded as national support projects.

(1) **Methanol project**

The project calls for the construction of a plant with an annual production capacity of 600,000 tons of chemical-use methanol. It is to utilize the natural gas by-products of the oil produced in Al Jubail in the eastern industrial zone of Saudi Arabia. This is a joint venture project involving Japanese methanol makers, traders, the Overseas Economic Cooperation Fund (OECF) and the Saudi Basic Industries Corporation (SABIC). In November 1979, an agreement for this joint venture undertaking was concluded between the Japanese-side investment company Japan Saudi Arabia Methanol Co. and SABIC, with funds invested by the Japanese government to promote the project. In February 1980, a local company, the Saudi Methanol Co., was formed, and presently work is starting, with completion of the project scheduled for January 1983.

(2) **Petrochemical project**

This petrochemical project calls for the construction in Al Jubail (the location of the methanol plant also) of a petrochemical complex, which will use natural gas by-products to produce 500,000 t/y of ethylene, 130,000 t/y of low density polyethylene and 300,000 t/y of ethylene glycol. (Ethylene and ethylene glycol will be produced jointly with a Dow Chemicals-Saudi hook-up; the Japan-Saudi share of the production will be 230,000 t/y of ethylene and 150,000 t/y of ethylene glycol.)

Like the methanol project, it is a joint venture between Japan and SABIC.

In May 1981, the Japanese-side investment company Saudi Petrochemicals Development Co., Ltd. concluded a joint venture agreement with SABIC, and the Japanese government, in consideration of the importance of the project, decided on funding for it. At present, both Japan and Saudi Arabia are preparing for the formation of a local company. The company should be established soon, upon which construction surveys will begin. The plant will begin operation by the end of 1985.

## Conclusion

As mentioned above, the two projects carry great weight in the conclusion of economic and technical cooperation between the two nations. Former prime minister Fukuda and other cabinet members who have visited Saudi Arabia have all emphasized their willingness to continue active support for the projects.

Furthermore, the government of Saudi Arabia is actively promoting these two projects as part of its industrialization policy. In these ways, the two projects well match the needs of both countries.

After all the surveys and negotiations, we eagerly await the completion of these significant projects in Al Jubail, and hope for their great success as symbols of friendly relations and economic and technical cooperation between Japan and Saudi Arabia.

CSO: 4120/280

## SCIENCE AND TECHNOLOGY

# EXPANSION PROGRAM FOR NTT in 1981 EXAMINED

Tokyo LOOK JAPAN in English Vol 27, No 304, 10 Jul 81 pp 22, 26]

[Text] *NTT's investment program for fiscal 1981, the fourth year of the 6th Five-Year Expansion Program (1978-1982), has recently been approved by the Diet. The total planned investment amounts to 1,770 billion yen.*

*The aims of the program are: to successively adjust the system to respond to new subscriptions and subscriber moves without creating backlogs, and to cope with the increase in utilization of calls; to improve telephone service particularly in sparsely populated areas; to strengthen telephone service for social well-being; to develop and introduce into wide use various telecommunications services such as automobile telephones, the digital data exchange network, and the public facsimile communications network.*

*Furthermore, in terms of hardware facilities, NTT will offer quality telecommunications services and abolish service differentials by replacing old switching systems with new ones, and promote digitalization of facilities in order to form a more economical telecommunications network. NTT will make efforts to improve the reliability of its telecommunications network and to promote disaster-prevention countermeasures, including ones for large-scale earthquakes.*

*Thus, NTT will actively respond to the people's diverse and sophisticated demands for telecommunications services, contribute to realizing an enhanced national lifestyle, and promote efficient socio-economic activity.*

## Basic Principles

The outline of the program is as follows:

- Further proliferation of ordinary subscriber lines and expansion and improvement of basic facilities to maintain the supply-demand balance for subscriber lines, and the offering of diverse and sophisticated telecommunications services in a more economical way.
- Decentralization of toll switching systems and multi-routing of transmission lines, in order to upgrade reliability.
- Formation of a digital communications network, and the expanded application of common channel signaling system (CCS), in order to further the economization and sophistication of the communications network.
- Enlargement of closed numbering areas and local service areas, and replacement of rural community group telephones to ordinary subscriber telephones, as one aspect of the telephone service improvement program.
- Promotion of diversification and sophistication of telephone services.
- Installation of public telephones that can be used all day long and that are more convenient for long-distance calls, etc.
- Expansion of data communications channels, promotion of the introduction of more public and technology-

Fig. 1: Total Subscriber Lines

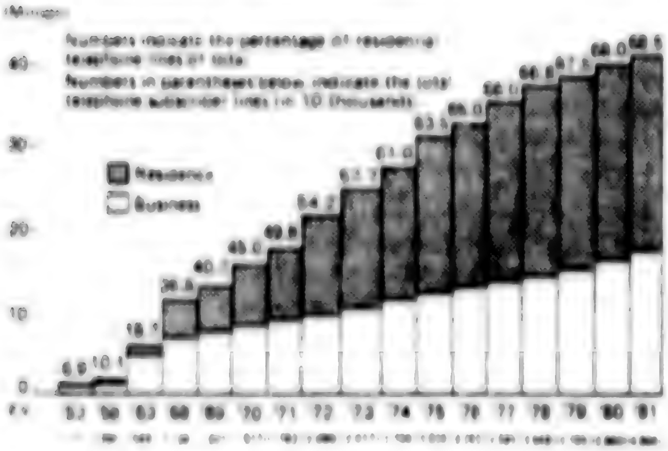
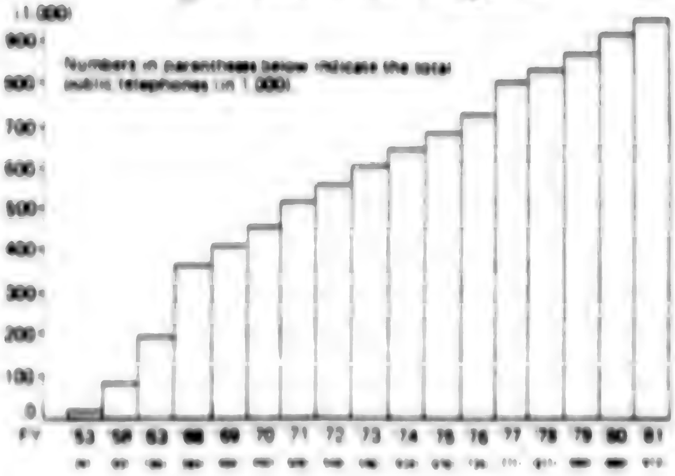


Fig. 2: Total Public Telephones



oriented data communications systems, and expansion of the service areas for the digital data exchange network service.

- Expansion and introduction of public facsimile communications network service to promote visual communications service.
- Expansion and introduction of automobile telephone service to facilitate mobile communications.
- Promotion of disaster countermeasures to maintain telecommunications services during emergencies.
- Promotion of more efficient operation and modernization of NTT's business.

## Outline of the Program

The details of the expansion program are as follows:

### (1) Telephone Services

(a) Installation of subscriber lines

NTT plans to install 1.30 million new subscriber lines (1.35 million in fiscal 1980) during this fiscal year to meet customer demand. Among them, the percentage of residential telephone lines served by new lines will be about 80%. With the new installations, the total number of ordinary subscriber lines will increase to 40.04 million by the end of fiscal 1981 (Fig. 1). The percentage of residential telephone lines in the total number of subscriber lines will reach 68.5% and the number of subscriber lines per 100 population will be improved to 34.0. In addition, NTT expects 2.1 million subscriber moves in fiscal 1981 (2.1 million in fiscal 1980). Such moves are increasing yearly in response to rising social mobility.

(b) Expansion of public telephones

NTT plans to install 74,000 public telephones (70,000 in fiscal 1980), especially ones that can be used all day long. With this, the total number of public telephones will increase to 912,000 (Fig. 2). And the number of public telephones per 1,000 population is expected to climb to 7.7 by the end of fiscal 1981.

(c) Promotion of sophistication and diversification of telephone services

In order to meet customer needs, NTT will actively sell telephones that have new functions for the convenience of subscribers, such as push-button telephones, home key telephones, branch telephones, and business telephones. During this fiscal year, NTT plans to sell 630,000 push-button telephones, 220,000 home key telephone sets, 670,000 branch telephones, and 700,000 business telephones (530,000, 180,000, 670,000, and 650,000, respectively, in the previous fiscal year). As a result, the total number of push-button telephones will reach approximately 3.74 million by the end of fiscal 1981.

### (2) Improvement of Telephone Services in Sparsely Populated Areas

In order to improve telephone services in sparsely populated areas, NTT plans to successively enlarge the radius of the local service area to 7 km from a telephone office, and also plans to change rural community group telephone lines to ordinary subscriber lines.

(a) Enlargement of local service areas — 240 areas (345 areas in fiscal 1980)

(b) Change of rural community group

**Table 1: Main Items of the Expansion Program**

| Item | FY 1980 | FY 1981 |
|---|---|---|
| Subscriber lines | 1,250,000 | 1,300,000 |
| Subscriber moves | 2,100,000 | 2,100,000 |
| Key telephones | 650,000 | 700,000 |
| Home key telephone sets | 180,000 | 220,000 |
| Push-button telephones | 530,000 | 630,000 |
| Branch telephones | 670,000 | 670,000 |
| Public telephones | 70,000 | 74,000 |
| Telephones for social well-being | 45,000 | 45,000 |
| Facsimile terminals | 12,000 | 15,000 |
| Construction of telephone offices | 277 | 225 |
| Coaxial cable systems (in section) | 116 | 102 |
| Microwave systems (in section) | 244 | 203 |
| Optical fiber cables (in section) | 3 | 12 |
| Data communications systems | 32 | 25 |
| Telephone diffusion program in sparsely populated areas | | |
| Change of rural community group telephones into ordinary subscriber lines | 200,000 | 140,000 |

**Table 2: Level of Communications Services**

| Item | FY 1980 | FY 1981 |
|---|---|---|
| Subscriber lines | | |
| Total number of subscriber lines (in thousands) | 38,600 | 40,040 |
| Percentage of residential telephones (%) | 68 | 68.5 |
| Number of subscribers per 100 population | 33.2 | 34.0 |
| Public telephones | | |
| Total number of telephones (in thousands) | 880 | 912 |
| Number of telephones per 1,000 population | 7.5 | 7.7 |

telephone lines to ordinary subscriber lines — 140,000 subscriber lines (200,000 lines in fiscal 1980)

### (3) Expansion of Closed Numbering Areas

Considering requests of the community and the wider mobility of lifestyles, NTT plans to expand areas where one can call without dialing the toll telephone number within the area with the same rate system.

### (4) Construction of Telephone Offices

As for the construction of telephone offices, NTT plans to improve and strengthen basic telephone facilities so as to open new local telephone offices, considering the stagnant conditions of facilities in telephone offices. Furthermore, NTT will promote the introduction of electronic switching systems (ESS), and also inaugurate the introduction of digital switching systems.

(a) Construction of new local telephone offices

NTT plans to construct 194 new local telephone offices (244 offices in fiscal 1980), 84 of which will be brought into service during this fiscal year.

(b) Construction of new toll switching offices

NTT plans to construct 31 new toll switching offices (33 offices in fiscal 1980), two of which will be brought into service during this fiscal year.

(c) Installation of ESS

NTT will actively introduce ESS (local and toll electronic switching systems) into telephone offices. 176 systems in 170 telephone offices will be brought into service in fiscal 1981 (149 systems in 139 telephone offices in fiscal 1980).

(d) Installation of digital switching systems

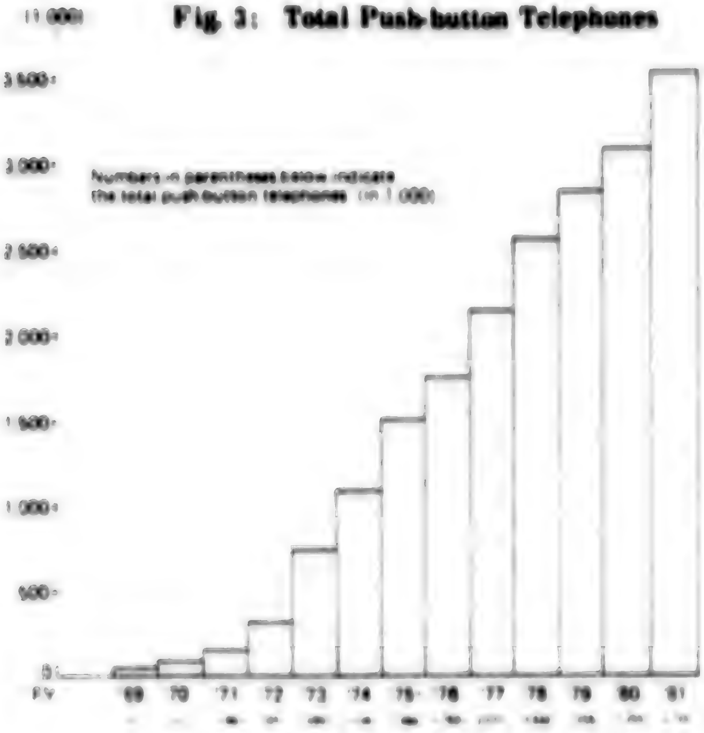
NTT plans to introduce a toll digital switching system.

### (5) New Installations of Telephone Circuits and Construction of Transmission Lines

(a) Toll circuits

NTT plans to introduce a toll digital

Fig. 3: Total Push-button Telephones



circuits to cope with the increasing traffic in telephone usage. As a result, the total number of toll circuits will reach 2,140,000 (Fig. 4).

(b) Transmission lines

NTT plans to promote digitalization of transmission lines, in addition to securing the transmission lines necessary for maintenance and improvement of toll telephone services. Thus, 102 sections for coaxial cable systems (116 sections in fiscal 1980) and 203 sections for microwave systems (244 sections in fiscal 1980) will be constructed during this fiscal year. Among them, 139 sections for digital transmission lines will be constructed (133 sections in fiscal 1980). In addition, 46 sections for coaxial cable systems and 65 sections for microwave systems will be brought into service during this fiscal year. Among them, 43 sections for digital transmission lines will be opened. Moreover, 12 sections for optical fiber cable transmission systems are planned.

### (6) Data Communications Service

(a) Expansion of data communications service

As for data communications systems, NTT plans to expand mainly such systems as the public and nationwide ones, and the development-incentive ones.

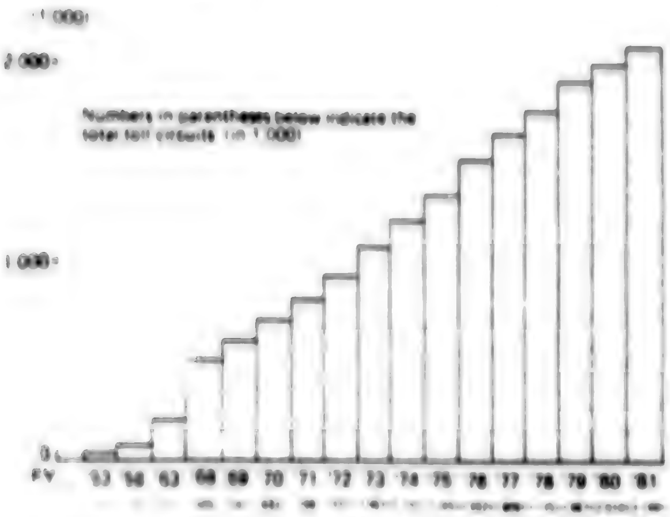
(i) Public data communications services

In these systems, a large number of customers jointly use NTT's large-scale and high-performance computer systems, such as DIPS (Dendenkosha Information Processing System), using the telephone network and leased circuits. At present, these services are DRESS (Dendenkosha Real-time Sales Management System—sales and inventory management service) and DEMOS (Dendenkosha Multi-access On-line System—scientific and engineering calculation service). Since these services will contribute to the popularization of computer usage, NTT will actively promote them.

(ii) Private data communications services

This service is designed on an individual basis according to the needs of such computer users as private companies and government agencies. In this

Fig. 4: Total Toll Circuits



fiscal year. NTT plans to construct 25 systems, including the Social Insurance Processing System, as one aspect of the large-scale national project (32 systems in fiscal 1980).

(b) Expansion of data communications systems

NTT plans to install 25,000 circuits for leased data transmission in use for data communications by private companies in order to meet various needs (22,000 circuits in fiscal 1980).

(c) Expansion and improvement of digital data exchange network service

The digital data exchanging service is an information switching service with a meter rate system, which is appropriate for communications between computers, between a computer and a data terminal, and between data terminals. The digital data network service comprises a circuit switching service and a packet switching service. In fiscal 1981, NTT plans to extend the service area for the two services: 15 new cities for circuit switching service (four cities at the end of fiscal 1980) and 23 new cities for the packet switching service (seven cities at the end of 1980).

### (7) Visual Communications Services

(a) Active promotion of facsimile communications service

NTT plans to actively proliferate facsimile communications that contribute to efficient economic activities, and thus plans to 15,000 facsimile terminals (12,000 terminals in fiscal 1980).

(b) Expansion and development of video communications service

As for video transmission systems that will contribute to more effective socio-economic activities, NTT plans to install 90 circuits in order to meet all kinds of demands.

### (8) Mobile Communications Services

In response to the demand for more mobility and speed, NTT plans to introduce automobile telephone service in major cities.

As for maritime mobile telephone service, NTT plans to install circuits and facilities that are necessary for the increase in demand and the shift to automatic exchanging systems.

Moreover, NTT plans to increase and expand the scope of its pocket bell service.

### (9) Replacement of Old Switching Service

As for the replacement and preparation of facilities, owing to the offering of quality telecommunication services and service differentials brought about by facilities, NTT plans to replace about 1,100,000 old switching systems to new ESSs, and also plans to replace actively time-worn cables.

### (10) Disaster Countermeasures

In order to prevent the interruption of telecommunications services during emergencies, NTT plans to promote disaster countermeasures such as the construction of cable tunnels and the multi-routing of junction circuits in major cities, and the provision of transportable emergency exchange equipment and large-capacity transportable power generating equipment. In addition, NTT plans to conduct countermeasures for the security of public telephone calls during emergencies as one part of countermeasures for large-scale earthquakes.

- Transportable emergency radio equipment—180 sets
- Transportable emergency exchange equipment—10 sets
- Construction of cable tunnels in major cities—16 km
- Multi-routing of junction circuits in cities—16 sections

### (11) Effective Operations

NTT plans to introduce computerization for calculating telephone rates through the introduction of new technologies in order to actively promote reduction of expenditures, modernization, and labor conservation in NTT's business affairs.

CSO: 4120/280

SCIENCE AND TECHNOLOGY

## SPC SYSTEM TO UPGRADE C400 XB EXCHANGE

Tokyo LOOK JAPAN in English Vol 27, No 304, 10 Jul 81 pp 24, 26, 27]

[Text] ***With the remarkable developments in the information handling industry, besides serving as a means for subscribers to talk to each other, the telephone network has started to offer many other important services to the public. Although the electronic switching system has been actively introduced for local switching in Japan, the crossbar switching system is still used for most local switching networks. A major issue in the provision of new services is how the best use can be made of existing equipment. Toward this end, the functions of the crossbar switching system, and in particular of the Model C400, which is widely employed as a standard switching system in Japan, have been upgraded by improving its control function, such as the addition of an originating-number identifier/sender, until they approach the level of electronic switching systems. This has been achieved through the addition of stored-program control (SPC) facilities, which, besides making new services possible, also make maintenance and the attainment of reliability much easier.***

The Japanese telephone network has recently fulfilled two major telecommunications goals: the elimination of the unfilled telephone demand backlog and the accomplishment of a complete, nationwide subscriber dialing service. However, the existing telephone network will have to be rapidly upgraded if it is to answer the ever-growing demand for new customer services that arise from the increasing diversity and sophistication of modern social activity.

In Japan, about 85% of the subscribers are already served by crossbar switching systems, but the continued reliance on wired logic alone as new functions are added to the network would impose restrictions on the nature of new services, and make possible only a limited response to customer needs. To provide more flexibility in new functions, electronic devices that use the stored-program control scheme having an interface to markers have been realized. The greater flexibility appears in the areas of (1) functional upgrading of the telephone network, (2) better maintenance, and (3) the provision of new telephone service.

The nature and the role of these electronic devices is described below.

### Basic Policy in Developing Additional Electronic Equipment

The additional electronic equipment has been developed on a design philosophy wherein the basic part of the existing crossbar switching system should be used as is and various new services and centralized maintenance should be provided by the stored-program control technique.

### Originating Number Identifier/Sender

The trunking diagram for a service in which the Model C400 — a representative local switch in crossbar switching systems — is connected to another network by special number 1XY and the originating subscriber number is trans-

Fig. 1: Total Number of Switching System Subscriber Terminals

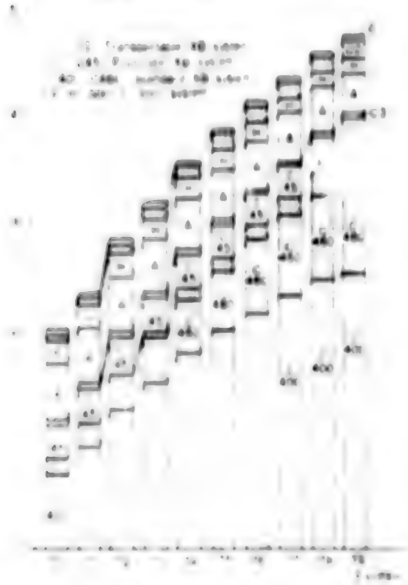
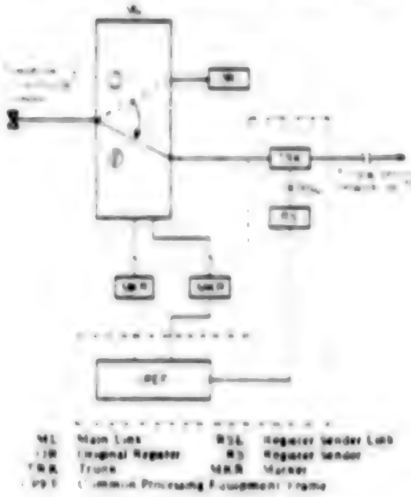


Fig. 2: Trunking Diagram



mitted to the line, is shown in Fig. 2. One of the basic functions of a local switch is to send out originating subscriber numbers to the network. The common processing equipment frame (CPEF) interfaces with markers and performs the originating number identification and sending function, which the crossbar exchange has thus far been unable to perform. The additional electronic equipment is a stored-program controlled unit consisting of a small-scale 16-bit processor (See photo).

In developing this equipment, functions are clearly defined for this and the existing equipment. For example, when a calling party dials a special number, the marker only sets up a route between the calling party and the trunk in the same manner as for ordinary connection, and the CPEF performs the other related operation. In addition, the equipment has been designed so as to minimize the required modification of the existing equipment and provide versatility in future functional expansion.

## Basic Operation

The CPEF shown in Fig. 2 operates basically as follows:

(a) When a caller lifts his receiver, the telephone is connected through route (1) to the originating register, which returns dial tone to the caller.

(b) When the caller dials a new service access number (1XY), the originating register activates the marker and sends 1XY and the calling line location on the main link to the marker.

(c) The marker selects an idle trunk on the new service train and sets up route (2), when an act signal (seizure signal) is issued to the CPEF. Then, the marker restores to normal.

(d) The trunk activates and causes the register sender link to connect itself to the register sender, which in turn issues an act signal to the CPEF.

(e) The CPEF is constantly scanning all markers and register senders for their act signals. When a marker or register sender raises its act signal, the CPEF reads its data through the scanner.

(f) The CPEF reads the data (1XY, trunk number and line location information) for the marker first by its act signal, and converts the line location information into the caller's directory number.

(g) Then, the CPEF reads the data (trunk number) for the register sender by its act signal, and extracts the caller's directory number from the marker data using the trunk number as a key.

(h) The CPEF sends XY (note that '1' has been deleted) and the directory number to the register sender, thereby terminating its operation.

(i) The register sender sends the second dial tone through the calling line to prompt the calling party to dial the directory number of a party to be called. On receiving the called party's directory number, the register sender transfers 1XY and the called and calling party's directory numbers through the transit switch to the new service network, then restores to normal.

(j) The calling line is now connected to the new service network, and necessary information is transferred between the terminal on the calling side and the new service network on an end-to-end basis.

### Equipment Configuration

Fig. 3 shows the basic configuration of the additional electronic equipment. This equipment basically uses a normal-emergency (duplicate) redundancy scheme. However, the scan matrix unit (MTXU) and relay driver (RDV), which interface with the electromagnetic section, and the flexible disk driver (FDD), which functions as backup memory, are not duplicated.

Information sent from the central controller (CC) to the electromagnetic interface section is relayed by the scan bus driver (SBD) and directed to the scanner controller (SCNCONT) or relay driver controller (RDVCONT) through the scan bus, which permits interframe transfer of information.

The MTXU and main memory (MM) can be expanded. The required number of MTXUs depends on the number of markers used in each office. In the basic configuration, the main memory size is 32 K words for a small number of new service subscribers. It can be expanded to a maximum of 256 K words to provide additional functions.

## Functional Expandability

### Add-on Functions

The existing crossbar switching system, with the added SPC equipment that provides the originating number identification and transmission function described in the previous item, permits switching to another network. Thus, it permits easy application to new services, such as public facsimile communications system and international direct distance dialing. Besides, by adapting magnetic bubble memory equipment, scanner and driver equipment, data transfer equipment and so on for this system, functional enhancement can be realized as follows:

(1) Number group functions

This function eliminates;

(a) Number group operation by service order and C-wire jumpering on the Main Distributing Frame (MDF).

(b) Restrictions on the correspondence between line location and directory number, which can cause a greater number of jumper wires on the MDF and the frame to require a large space.

(c) Installation of new jumper wires for paths used for storing subscriber information when new services are provided.

(2) Remote-controlled service barring/release

Instant control of service barring/release is possible from a remote maintenance center whenever necessary.

(3) Metering service

(a) Remote reading of call meters in unattended offices is possible.

(b) Charge indexes are stored in magnetic tapes for speedy charging service.

(c) Tests are not required on the call meters which must operate at high occupancy rates and with high accuracy.

(4) Local automatic message accounting service

(a) Issuing conversation charge account for every subscriber is possible.

(b) Smoothing tasks for inquiry on conversation charge is possible.

(5) Traffic observation

Since this additional electronic equipment permits centralized traffic measurement, various traffic measuring instruments are not needed.

### System Outline

In selecting a system that enables the addition of functions, the following items were studied as basic development policy:

(a) Modernized maintenance and administration

(b) Easy introduction of new functions

(c) Reliability as high as that attained by the existing system

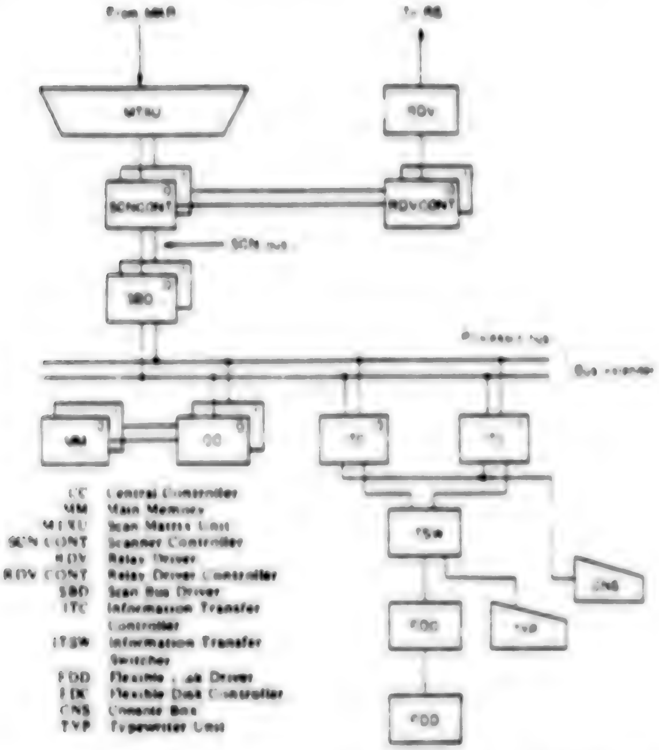
(d) Minimized modification on the existing system

*Hardware Features*

(a) A duplicated small-scale 16-bit processor is used as the central controller.

(b) Main memory consists of 16 K

Fig. 3: Blockdiagram of Additional Electronic Equipment



bits/chip ICs

(c) Bus extender is used to enable the expansion of various auxiliary memory equipment.

(d) Typewriter units and a magnetic tape unit are used for I/O devices for remote control from the maintenance center.

These equipment are shown in the photo.

*Software Features*

Programs consist of functional modules for localized addition or alteration to reduce the adverse effect on the existing program to a minimum.

*Operation Summary*

The CC is constantly scanning the act signals for all markers and the called-subscribers' answer signals for all trunks. When a change in the scanned bits is detected by the CC, the CC carries out adequate processing, as shown below.

(1) Number group functions

(a) When a marker generates its act signal, which indicates an intra-office call or a terminating call, the CC detects the signal and reads more detailed information (the directory number for a called subscriber) through the scanner.

(b) The CC translates the above data obtained through the scanner into the line location of the called subscriber, referring to the subscriber data stored in the magnetic bubble memory equipment. Moreover, when the called subscriber's number is a pilot number for a PBX group, the CC selects an idle PBX line by referring to the busy/idle memory of the PBX group stored in the magnetic bubble memory equipment, and then translates it into the line location.

(c) The CC sends the information on the line location of the called subscriber to the marker through the RDV.

(2) Remote-controlled service barring and its cancellation

(a) After detecting an act signal, which indicates an intra-office call, an outgoing call or a terminating call, of a marker, the CC reads more detailed information (the calling subscriber's line location or the called subscriber's directory number) from the marker through the scanner.

(b) The CC generates barring information, if the subscriber data for the above subscriber indicate that the calling subscriber (or the called subscriber) is to be refused.

(c) The CC sends the barring information to the marker through the RDV.

(3) Metering function

(a) After detecting an act signal, which indicates an intra-office call or an outgoing call for a marker, the CC reads more detailed information (the called subscriber's directory number, the calling subscriber's line location and trunk's line location) from the marker through the scanner.

(b) The CC supervises the related trunk by using the scanner, and calculates the conversation time after detecting the answer and clear back signals for the called subscriber.

(c) The CC calculates the number of charge units with the called subscriber's directory number and the conversation time and adds the number to the metering memory corresponding to the calling subscriber in the magnetic bubble memory equipment.

## Application to Future Service

This additional electronic equipment, which is now ready for service, was principally intended to supply the originating number identifier function, which will become indispensable as new services are added in the future. By introducing various data storage and processing functions, the equipment makes it possible and easy for the existing crossbar switching system to offer a variety of new services and functions, a task which it had hitherto been though incapable of performing. Accordingly, this equipment has been designed to allow for the easy expansion of memory capacity, extension of processor bus, and addition of electromechanical-electronic interfaces. Moreover, there is a service which requires this function; it is the public facsimile communications system, that is scheduled to go into operation in 1981. What is more, new functions that can be foreseen at present include electronic number group, international direct distance dialing, various remote control functions, and electronic subscriber meters. Field testing on these new functions has been carried out since April 1980.

## Conclusion

With many improvements in functions supplied by the addition of various electromechanical and electronic devices, the crossbar switching system has been upgraded to provide better and better service to subscribers. Parallel to this, the addition of stored-program control equipment was already known to be technically feasible. Now, in the new public facsimile communications system, the originating number identifier/sender has become a reality. This addition of new functions for new services by this equipment will expand the flexibility of the crossbar switching system to the point where its capabilities approach those of electronics switching systems.

The additional electronic equipment needed for the public facsimile communications system are now being installed in quantity in preparation for commercial testing.

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## SCIENCE AND TECHNOLOGY

### BRIEFS

FAA TO CERTIFY MU-300--Mitsubishi Heavy Industries Ltd. (MHI) expects the U.S. Federal Aviation Administration (FAA) to give a type certificate to its MU-300 business jet by August if flight tests of preproduction aircraft continue smoothly. The MU-300 is the first business jet developed in Japan. MHI, which has already received 115 MU-300 orders, intends to start their delivery as soon as the certification is received. The monthly production rate is projected at eight aircraft. Delivery of the aircraft now on order will begin around 1982. Mitsubishi Aircraft Int'l (MAI), MHI's affiliate in the United States, will undertake final assembly of the MU-300s. A new building for an MU-300 assembly line has been built at its San Angelo plant in Texas. MHI has already shipped eight MU-300s, including two prototypes, to the United States mainly for the FAA's certification tests. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 p 3]

MITI CONSIDERS MT-X PROPOSALS--The Ministry of International Trade and Industry (MITI) is considering three airframe manufacturers' proposals for the development of the Air Self-Defense Force's MT-X intermediate jet trainer with a view to business coordination under the aircraft manufacturing business law. It has already been briefed on the proposals by Mitsubishi Heavy Industries Ltd., Kawasaki Heavy Industries Ltd. and Fuji Heavy Industries Ltd. The ongoing study will serve as the basis for consultation with the Japanese Defense Agency (JDA) on the selection of a prime contractor and subcontractors which will come by September. The MT-X program is planned to start with basic engineering in October 1981. The JDA's study of the three proposals has already reached a final stage. It intends to hold the consultations with MITI after selecting the prime contractor tentatively. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 p 3]

SECOND WEATHER SATELLITE--The National Space Development Agency (NASDA) announced last week it would launch in August another stationary meteorological satellite to replace the "Himawari" (Sunflower) satellite now in service. It said the "GMS-2" satellite will be launched on Aug. 10 by an N-II rocket from the Tanegashima Space Center, Kagoshima Prefecture, as the first practical-use satellite to be launched by Japan. "Himawari" was launched by the United States. The 650-kg cylindrical satellite, also manufactured by Hughes Aircraft, will replace "Himawari." After being launched, the new satellite will undergo checks over the Equator and then be put in orbit to replace its predecessor satellite at the end of the year and become Japan's second space observatory. Meanwhile, the National Institute of Space Science also plans to launch three rockets for observation purposes from the Kagoshima Space Center in Uchinoura, Kagoshima Prefecture, between Aug. 24 and Sept. 14. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 528, 1 Jul 81 p 9]

TANK ENGINE PROCUREMENT--The GSDF/TR&DI want to purchase a new gas turbine engine in FY 1982 for long-term basic research on future tanks as they failed to incorporate it into the FY 1981 budget request in August 1980. Although the GSDF/TR&DI are now proceeding with development of a new main battle tank, tentatively named the Model 88, after the Model 61 and 74 tanks, the basic research will be separated from the ongoing tank development program. They mounted the T-53-11A gas turbine engine (which powers the HU-1B observation helicopter) on an M-4 tank for basic research during the FY 1967-71 Third Defense Buildup Program period. But they have done no full-scale long-term basic research on future tanks. The engine, which the GSDF/TR&DI expect to procure in FY 1982, may be the U.S. Army XM-1 tank's gas turbine engine, according to informed sources. The U.S. Army is said to have approved release of the XM-1 tank engine for Japan. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 p 8]

SCOUT/RECONNAISSANCE APC DEVELOPMENT--The JDA's Technical R&D Institute (TR&DI) plans to start engineering development of a scout/reconnaissance armored personnel carrier (APC) for the GSDF in FY 1982 as evaluation and operational research using two prototypes have been completed. One problem still to be solved before the development involves a gun for the vehicle. The two prototypes fabricated from FY 1978 to 1979 are armed with 20mm machine guns of Rheinmetall Gmbh. But operational research has revealed the 20mm gun is not powerful enough to meet the GSDF's requirements. Instead of the 20mm gun, the TR&DI is considering the Swiss Oerlikon 35mm KDE gun and four 25mm guns are the Hughes Chain Gun, the Ford/Oerlikon KBA Canon, the Oerlikon KBB Canon and another under development by Rheinmetall. The gun selection is expected soon. Meanwhile, a command/communication APC for the GSDF is ready for procurement starting in FY 1982. Functional tests of the vehicle are to be completed in the first quarter of FY 1981. [Text] [Tokyo JPE AVIATION REPORT-WEEKLY in English No 527, 24 Jun 81 pp 8,9]

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